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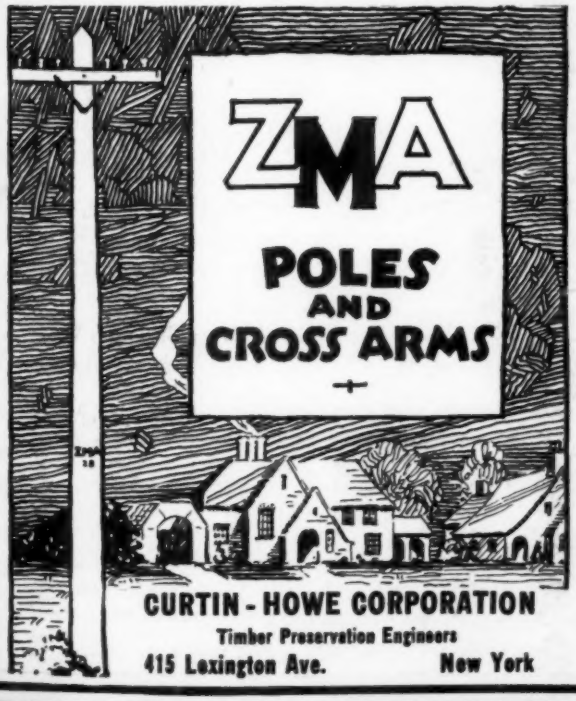

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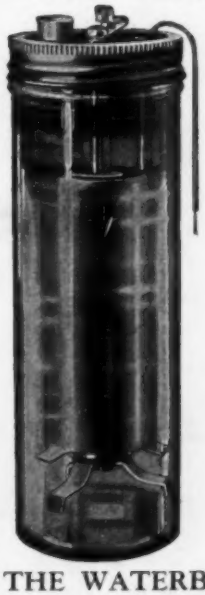

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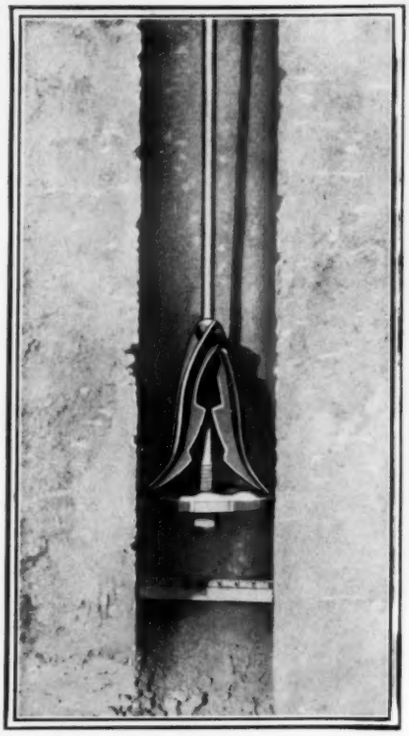

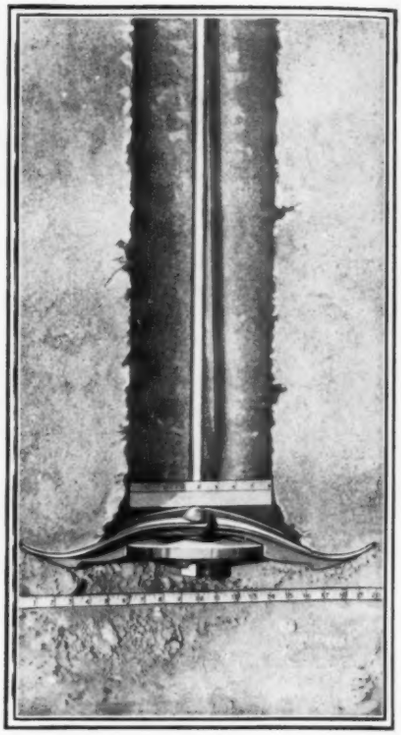

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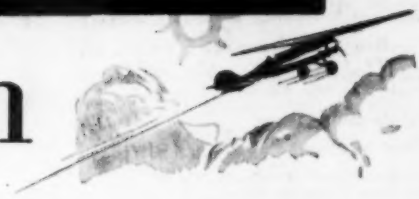

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Telephone Engineer

Volume 34 OCTOBER, 1930 No. 10

The Fighters of Public Utilities

The constant harangue of certain, so-called, statesmen and newspapers, with axes to grind, against public utilities in general and the telephone business in particular would all be clear if the public understood the motives behind the attacks. In every case there is a reason other than justice or patriotism which prompts the misrepresentation and abuse.

And where do most of these attacks come from? In one of our states the owners of the leading newspaper were once owners of considerable stock in a public utility. They wanted to get control of the utility but did not succeed. They had previously been prosecuted for making false affidavit of ownership of the paper and also for swearing to a false valuation of their newspaper for taxation purposes. Now they are the "holier than thou" leaders of antagonism to utilities making any profit on their investments, although it is said these same publishers make 40 and 50 per cent, every year, on the value of their newspaper.

The leader of the national fight against public utilities, who is said to be twenty times a millionaire, made his money in a few years manipulating the finances of a great automobile industry. He wants to prevent security holders in telephone and other utilities from earning 7 per cent on their investments. He made his by somebody taking huge profits from the automobile buying public, but he considers it almost criminal for public utilities to make money to pay interest to those who have their money invested.

And the last analysis of every other leading opponent of public utility growth and prosperity would show similar inconsistencies and selfishness. But it serves them a vehicle by which they assume to ride down any other prosperity than their own, and it is either done to cover up their own grab and greed or it's "much ado about nothing" for self glory or self advertising.

Pole Moving Cost Injustice

A real injustice to telephone companies is the constant expense of moving poles on public highways on order of somebody in authority. This would not be so burdensome if one moving would suffice, but it frequently happens twice and, sometimes, three times. Many instances are reported where county authorities have ordered telephone poles set back so the road might be widened and then along comes state authorities with orders to further widen the road which means another moving of the pole line. And, up to the present, we have heard of no limit of such moving expense that highway authorities will admit.

It may be according to the laws, as they now are, that telephone and other public utility companies must move poles on highways as often as ordered to do so by officials in control but that it is a financial imposition there can be no doubt and there ought to be some way to provide relief.

At least one state in our country, Minnesota, if we remember rightly, allows the actual expense of moving fences and poles where roads are widened. This is justice to the farmer who must not only move his fences but surrender some of his land beside, and it is also justice to the utilities which have set their property in the roadway where directed and then put to the expense of moving as often as road officials order it done.

Rates for utilities are fixed on investment and reasonable operating expenses but pole moving on highways is an expense that is absolute loss to owners and they ought not to be subjected to it for the benefit of any state or public because no such expense can be anticipated in establishing fair rates for service. If a man buys a farm and the state takes a part of it for roadway purposes he ought to be paid for it, and if utilities are given the use of highways, as the law directs, the burden of expense of changing their property location should be on those who compel it.

As to Patronizing Home Enterprise One of the gripping policies of acquiring and increasing friendly public relations for any public utility is to build a reputation that managers and employees consistently patronize home enterprise and actively participate in all public betterment movements. This is considered, by some, an infringement on their rights to buy where they please and to fold their arms and "stand by" when civic welfare is in need of help. But, notwithstanding the free American privilege of doing as we please, so long as we do not violate the laws of the land, it is poor business practice for one dependent on home patronage to turn his back upon those who support his business and spend his money with those who furnish no help of any kind for his home town and community. It may make him a few dollars in the immediate transaction but it will lose him money as the feeling of home business men grows against him and his business.

The public utility business is especially dependent on its home locality. It is, generally speaking, a monopoly and there is always more or less feeling against monopoly. But this can be greatly overcome by the management and all engaged in the enterprise standing up strong for the strengthening of home business prosperity. We may feel that we can do as we please, but doing the wrong thing, if we please, in the matter of helping home business interests will not add anything to our popularity as deserving citizens nor will it contribute any jingle to our cash registers nor encouraging comparisons in our annual financial reports.

This is a practical rather than a technical subject, but it is so closely related to the success of telephony that all engaged in giving telephone service can profit by practicing the upbuilding of good will for our business by clearly proving to our patrons that we deserve their favor, a desideratum that can never be accomplished by assuming an attitude of false reciprocity.

Future Planning for Rural Construction Growing scarcity of telephone pole timber, frequent widening and changing of highways, and hazard of sleet and wind storms on open wire construction is rightly demanding the attention of forward looking telephone plant engineers. Can we afford to continue building heavy, open air construction or does future probabilities prompt us to plan other than pole and wire construction for telephone purposes? Here is a question of serious moment for all who have heavily loaded lines through the country.

Up to the present time the American Telegraph & Telephone Company and its Bell subsidiaries are, with some recent exceptions, keeping their construction up on poles with open wires on cross arms. These people are leaders in telephone efficiency, or it is so generally understood, and with all their facilities for knowing how and why to build for the future their example is followed by most telephone companies in their construction and reconstruction.

But are they absolutely sure that theirs is the best plan? Not having dependable data at hand the writer is not in position to assuredly advise. However, it has been proven, beyond question, that underground construction, in cities, is very much better than open wire-up in the air facilities. This for the reason that upkeep costs, destruction by the elements and dependability of service all favor under-ground construction as best and, in the long run, cheapest.

Therefore it behooves all planners for the future to consider well the advisability of under-ground cable laying for carrying heavy leads through the country. Some companies are experimenting with armored cable as a probable solution of the matter and results so far are assuring of the success desired. This will do away with such expenses as line moving on highways and destruction by storms and doubtless guarantee better service.

Sale of St. Paul to Bell Arouses Wide Interest The sale of the St. Paul exchange of the Tri-State Telephone & Telegraph Company to the Northwestern Bell has aroused quite an interesting question which will be considered by the full Board of Directors of the United States Independent Telephone Association at the Convention, to be held at Chicago this month.

As to the particulars of the transaction, the telephone interests of the country are not concerned, as that is a mere money matter. But the effect on existing telephone investments and relations is of such import as to arouse widespread interest among telephone investors. Is it a violation of the Hall agreement that the Bell or Independent interests shall not purchase a telephone property without releasing a like amount of territory for sale to the group adversely affected by the transfer?

The matter has already been considered by the executive committee of the Board of Directors of the U. S. Independent Telephone Association, in connection with the Bell authorities, and the conference developed such a two-sided complex that the Executive Committee referred the proceeding to consideration of the full Board of Directors. And that, as we see it, was eminently proper. The Bell interests claim, and the St. Paul selling company corroborates, that the cities of St. Paul and Minneapolis are so nearly one that separate operating companies

are impractical both in point of service giving and the convenience of the public. And they also set forth that there is no other similar situation in the country wherein St. Paul-Minneapolis conditions exist.

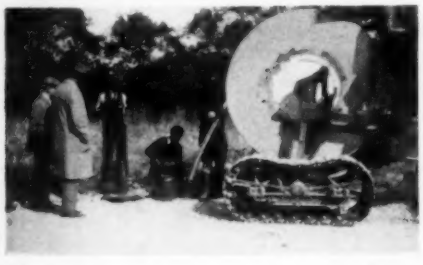
But to many Independent interests this set-up of necessity of violation of the Hall agreement is neither logical nor convincing, and herein is the nub of the question for the Independent directors to seriously consider. If the Bell has holdings similar to St. Paul it will release for purchase by Independents that would easily put all in the clear, but if not, the transaction may start something seriously detrimental to the entire telephone industry.

Inasmuch as the question is of such important concern as to prompt the committee, which heard the statement of the case, to refer it for consideration to the full jury of the Independent interests of the country, the Association should, and no doubt will, seriously consider the matter and act for the best interests of continued peace and prosperity with special favors to none. That is what it ought to do if telephone confidence and prosperity for all is to continue.

Cable Pulling Compound Labor Saver

Ray Blain Believes New Invention Saves Time and Money for the Company and Makes the Job Easier for the Workman

Telephone construction men have always realized the advantages of thoroughly lubricating lead cable before pulling in either aerial or underground. I will never forget the first time I pulled in a long section of cable without any lubrication and when the splicer started work he found that the lead sheath had



No. 1—Lubricating 3¼-in. cable, using a pump

slipped which had caused the paper insulation to slip baring them in such a manner that 10 pairs were shorted and crossed together. On aerial cable in addition to the heavy pulling strain possibly injuring the sheath the rings are usually slipped on the messenger if a good lubricant is not used.

While cable lubrication has always been necessary it is even more so with present construction practice which makes use of longer sections between manholes and numerous curves in the conduit line.

Grease was first used as a cable lubricant by applying directly to the sheath at the pulling end, also by forcing into the conduit thru a flexible pipe so as to lubricate its entire length. Applying ordinary grease directly to the cable is never satisfactory as it is rubbed off for a considerable distance from the pulling end and thereby loses its effectiveness. Greasing of the duct reduces the pulling-in strain about 50 per cent but has the disadvantages of being slow and expensive. Some make use of a swab to pull through the conduit to grease its entire length but this method is slow and never entirely satisfactory.

Pulverized soapstone has been used for several years as a cable lubricant with only partial success. While soapstone is cheap it has the disadvantage of being most difficult to get into the conduit line for its entire length. It also blows about, is wasted in a high wind, and bothers men's breathing when used in a manhole.

There has recently come onto the market a new cable pulling compound which seems to combine all the advantages of the different lubricants formerly used in cable pulling, but at the same time eliminates all their disadvantages. Yes, I believe it goes still farther than this for it meets all requirements and yet permits application directly to the cable at the pulling end, does not scrape off as does grease for it adheres to the cable and insures lubrication for the entire length of the pull.

No. 2—A rapid pulling rate with cable entirely coated

Tests were made with soapstone and grease in a 3½ inch tile conduit which indicated the following approximate pulling strains. With grease the pulling strain reached 3,550 pounds on a 350 foot length of cable. When soapstone was used the strain reached 1,750 pounds on a 335 foot length of cable and with the new cable pulling compound the strain reached only 700 pounds on a 330 foot cable pull. This compound works equally well on any type conduit and at about any temperature one would care to work on a cable job.

The pulling-in of a section of cable 2 inches in diameter will require 25 to 30 pounds of soapstone or grease, will require only 5 pounds of the new cable pulling compound. This compound is so

No. 3—Applying lubricant with a brush

successful that it should be used on every cable job and a sufficient quantity should be worked into every estimate to insure quick and easy placing of all lead cable both aerial and underground.

PURCHASES FIVE NEW OPERATING COMPANIES

The purchase of five new telephone operating companies in Wisconsin by the Associated Telephone Utilities was announced recently by Marshall E. Sampsell, president.

The purchased companies include the Farmers Inter-County Mutual Telephone Company at Kilbourn, Delton Telephone Company at Mirror Lake, Friendship Telephone Company at Adams, Adams County Metallic Telephone Company at Strong's Prairie, and Bingham Telephone Company at White Creek.

Telephone Transmission Computations

Necessity for Satisfactory Transmission Standards—Transmission Equivalents for 15 Common Types of Circuits—Sample Transmission Computations by T. De Witt Talmage, Transmission Engineer, Illinois Telephone Association, Springfield, Ill.

T. DeWitt Talmage

The problem of furnishing the telephone customer with adequate volume and quality of transmission for all types of service is becoming more complex as the improvements in the art of telephony have increased the range over which telephone conversations can be made. According to data recently made public by the Department of Commerce, the United States is now connected to approximately 87 per cent of the world's telephones and further extensions are under way. This means that a subscriber in the United States can talk to Mexico, Canada, Cuba, almost any country in Europe, as well as to the most important points in South America and even to one city in Africa.

Then, too, better methods in telephony are being made necessary by the competition among communication systems. It is a known fact that more efficient methods are being introduced into the Post Office Department and that air mail is being used extensively. The telegraph companies are not asleep and as a result the telegraph service is better than it formerly was. Moreover, the telegraph companies are planning to widen the scope of their services by contracting with large oil companies for the use of filling stations in the capacity of adjuncts to branch telegraph offices. This is an important step to increase the service field of telegraphy, as an outstanding feature of this plan is the aid it will offer motorists.

All of which means that there is real competition for the communicating public's dollar. For these reasons telephone plants must be designed to furnish good service not only when calls are made within the same area but complete service to all other areas. By complete service is meant the ability to converse with any other station located within reach of the toll network.

It is unfortunate that in the past so many plants were planned along the rule-of-thumb or cut-and-dry method. This type of guesswork is sometimes referred to as "hunch engineering." The difference between "hunch engineering" and present day telephone engineering practices may be likened to the difference between a guess and an estimate. A guess is an opinion without any basis while an estimate is an opinion based upon a multiple of known facts. It is the object of this article to briefly discuss some phases of practical methods of determining and computing transmission losses in telephone circuits.

In order that the use of the telephone may be further stimulated for both long and short hauls, the transmission furnished must be such that the subscriber does not need to talk in a loud manner into the transmitter but may carry on a conversation in a normal tone of voice, speaking directly into the mouthpiece. In all well engineered plants the day of shouting and yelling into the telephone has passed out of the picture. The transmission to those points where trouble is observed must be improved in order to furnish universal transmission. To obtain satisfactory transmission, the component parts of the telephone network must be designed so that when any connection or arrangement or circuits is established, satisfactory transmission will result.

The engineer or plant manager when designing plant, therefore, should design not only to furnish service within the town but he should design the plant so that subscribers may talk anywhere at any time. This consideration may increase the plant investment but will probably stimulate more interest in the telephone service, resulting in an increased amount of business originating in the town. There is slight difference in the cost of placing 22 gage cable instead of 24 gage, or placing 19 gage cable instead of 22 gage, if the increased cost is weighed with the anticipated increase in revenue which may be derived.

We may summarize the provision of good transmission with the following three statements:

1. Derive standards for plant design

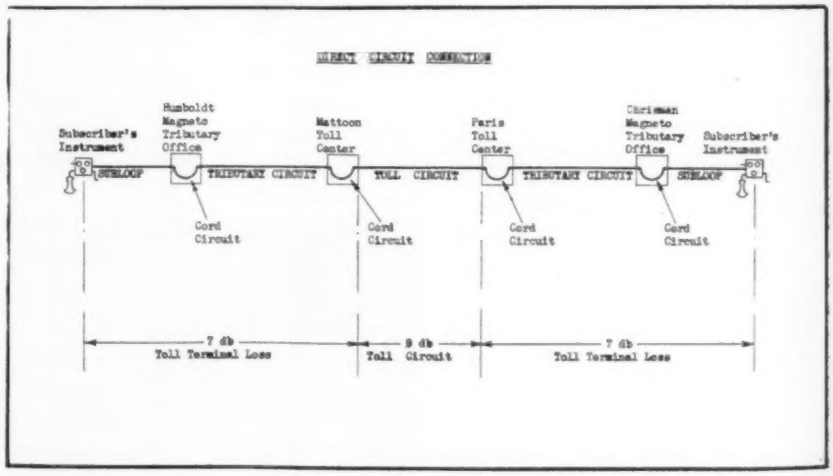


Fig. 1. Showing Standard Distribution of Transmission Loss in Connection Containing One Toll Circuit

which will furnish satisfactory transmission for all types of connections which customers demand.

2. Design, construct and lay out the plant to meet these standards.

3. Maintain the plant to keep it within the standards.

Considerable emphasis has always been placed on the necessity for the proper transmission design of toll plant. Recently special attention has been directed toward the efficient and economical transmission design of tributary trunk and subscribers' loop plant. This is for the reason that tributary trunk and subscribers' loop plant are important parts of the toll system and these portions of the plant must be designed so that when any subscriber in any area wishes to make a call either over toll or local facilities, satisfactory service will be rendered. In order to reduce confusion which sometimes results from crowding too much detail material into a short discussion, the principal part of this article will center around the design features of short haul toll and tributary trunk circuits. (A tributary exchange is an office whose toll traffic is handled by another office known as a toll center. A tributary trunk is a circuit between the tributary exchange and its toll center. This classification makes it possible to distinguish between tributary trunks and "toll" circuits, as "toll" circuits are circuits between two toll center offices.)

The fundamental unit of telephone transmission is called the bel, which name was derived from the name of Alexander Graham Bell and in his honor. In accordance with the terminology of the decimal system, the prefix "deci" is used to indicate a one-tenth relation. In other words, the word decibel means one-tenth of a bel. For convenience, the abbreviation db is employed to indicate the name decibel. The db represents a loss of electrical energy or force about equal to that caused by a mile of standard 19 gage cable. This relation is not quite mathematically correct but the comparison is close enough for most practical purposes. The limit of commercial transmission over normal telephone circuits is in the neighborhood of 30 db.

Certain standards have been set up by companies who have made a study of transmission problems. Fig. 1 shows the allocation of transmission losses in regard to the overall performance of a direct toll circuit connection. A direct toll circuit connection is one in which service is established between two toll centers or their tributaries by means of a direct toll circuit between the respective toll centers. The toll circuit in this case is designed for a transmission loss not to exceed 9.0 db. The toll terminal loss of 7.0 db. is the standard set up for use throughout the United States. The toll circuit loss includes the loss of the facilities (cable and open wire), the loss due to the toll line repeating coils, and the loss caused by supervisory relays or drops. The toll terminal loss includes the loss of the toll switchboard cord circuit, tributary trunk repeating coils, tributary trunk facilities (cable and open wire), tributary office switchboard cord circuit as well as the subscribers' loop losses. In order to meet the 7.0 db toll terminal loss, tributary trunk circuits should be designed on a toll switching trunk basis generally resulting in trunks of 3.5 db. Further on in this article it will be shown that in many cases it is almost impossible to meet the transmission requirements for tributary trunk circuits with the usual size of iron wire.

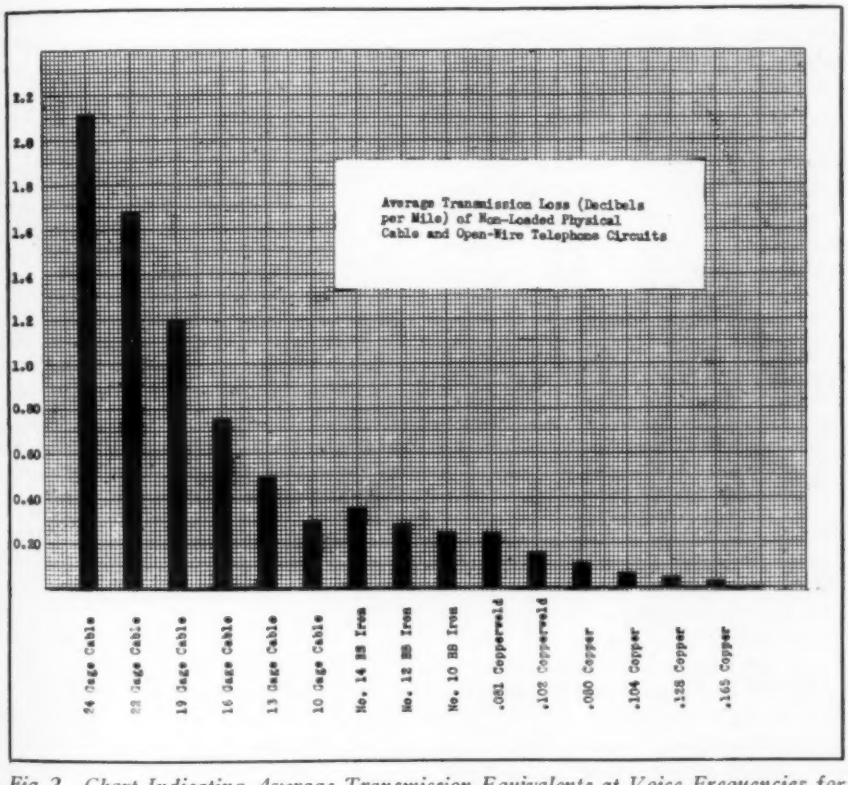


Fig. 2. Chart Indicating Average Transmission Equivalents at Voice Frequencies for 15 Non-Loaded Physical Telephone Circuits.

The overall transmission performance for a terminal connection (involving but one toll circuit), subscriber to subscriber, assuming a limiting toll terminal loss of 7.0 db effective should not exceed 23.0 db as shown in Fig. 1. A one-switch connection (involving two toll circuits) is planned to have an overall transmission loss not to exceed 26.0 db. Telephone connections which are designed with this standard as a basis will result in satisfactory transmission to the customer.

In designing circuits similar to those shown in Fig. 1 it is assumed that the modern switchboard cord circuit contributes very little transmission loss to the connection. For this reason it is extremely important where abnormally high switching losses do exist, that efforts be made towards the reduction of these excessive losses rather than include compensating reductions in the toll circuit design. Attention should be paid to the design features of existing switchboards which are obsolete if their transmission losses are resulting in adverse comment or complaint of the service. Often times a slight change in the central office equipment will reduce the number of poor transmission complaints with a relatively small cost to the company. Such items as antique repeating coils and poorly designed ring-off drops causing high transmission losses can be eliminated resulting in startling improvements in many instances.

Therefore, the starting point in the transmission design of outside plant circuits is to secure information concerning the loss introduced into the connections by the circuits within the central office. This item of transmission loss within the central office is so important that the Illinois Telephone Association has devoted a good deal of the time of its transmission engineering department to the determining of the transmission efficiency of central office equipment by means of a transmission measuring set.

In order to determine or compute the normal transmission loss of the many kinds of telephone facilities, certain tables have been compiled which give this information in terms of decibels per mile. Fig. 2 gives some transmission characteristics of 15 common types of non-loaded telephone circuits. This chart indicates

the transmission loss per mile at a temperature of 68° Fahr. This value is called the "transmission equivalent" of the circuit and represents the loss in the standard unit of transmission which a mile of that circuit under standard construction will cause when inserted in a telephone connection.

The electric resistance of wires increase as the temperature of the metal rises. An increase in the resistance of a circuit increases the transmission loss of the circuit. For that reason when the temperature is greater than 68° Fahr. the transmission equivalents of the circuits will be increased slightly over the values shown in Fig. 2. Wet weather increases the leakage of the open-wire circuits thus slightly reducing their efficiency. For that reason the wet weather transmission equivalents of the open-wire circuits will be slightly greater than indicated in Fig. 2.

The wire size of the conductors in the first six cable circuits shown in Fig. 2 is designated by use of the American wire gage, also known as the Brown & Sharpe gage. The next three iron open-wire circuits are designated in size by the Birmingham wire gage, the next two Copperweld (copper-clad steel) open-wire circuits are indicated in size in inches in diameter and the wire size of the last four copper open-wire circuits is also shown in inches in diameter.

The cable circuits' transmission loss varies somewhat for the same gage of conductors, due to the fact that cables are manufactured from different specifications resulting in different electrostatic capacities which affects the transmission equivalent. The transmission equivalents shown in Fig. 2 are the average losses of several representative types of cable.

One of the inherent characteristics of iron wire is its tendency to corrode or rust, thus reducing its tensile strength, as well as seriously affecting its transmission efficiency. Reports have been made based on studies in which the transmission efficiency of iron wire was investigated. In one study it was reported that the efficiency of iron wire was reduced 50 per cent in about 5 years, and that in about 10 years it was further reduced to but one-third of its original transmission effectiveness. Another authority states that the transmission losses of iron wire are subject to rather wide variations in practice, particularly because of the effects of corrosion. Some studies in the field indicate that, under what appeared to be representative Middle West conditions, the transmission loss of iron wire aproximately *doubled* in 10 years, and nearly *quadrupled* in 20 years.

Of course copper oxidizes when exposed to air, but the coating is protective and the oxidizing process is not progressive as with iron and steel.

The transmission equivalents given in Fig. 2 are for new iron wire.

Using the standards discussed in this article together with the transmission equivalents indicated in Fig. 2, it is comparatively easy to calculate the proper size and kind of wire to use in tributary trunk and toll circuits. The simplicity of the procedure is illustrated by means of the following three typical examples: A tributary trunk 10 miles long, with repeating coils at both ends, is to be built entirely of open wire. What gage and kind of wire should be used?

The total overall transmission loss of this trunk should be 3.5 db as outlined in the discussion of the standards which apply. Since the loss of the two repeating coils would total 1.4 db the loss of the open-wire portion of the circuit would be 3.5 db minus 1.4 db or 2.1 db. The open-wire section of the circuit is 10 miles long and the loss per mile would be one-tenth of the total loss of the section or one-tenth of 2.1 db which is 0.21 db. The problem now is to find a size and kind of wire which has a transmission equivalent not greater than 0.21 db. By referring to Fig. 2 and carefully locating the 0.21 db level on the left-hand side of the chart it will be noted that the Copperweld wire .102 inches in diameter will meet the requirements of this situation from the standpoint of transmission efficiency.

The next example is one in which there is a half mile of 19 gage cable and repeating coil at *each* end of a 14 mile tributary trunk circuit. What size and kind of wire should be used in the 13 mile section of open wire?

Referring again to Fig. 2 it will be noted that a mile of 19 gage cable has an average transmission equivalent of 1.19 db. The loss of the two repeating coils will be the same as in the previous example, namely, 1.4 db. Adding the loss of the cable and the repeating coils the sum is found to be 2.59 db. Subtracting 2.59 db from the total allowable loss of the entire circuit which is 3.5 db, gives 0.91 db, the loss which the 13 miles of open wire should not exceed. This means a loss per mile of 0.91 db divided by 13 or 0.07 db. The problem this time is to find an open-wire circuit which has a transmission equivalent not greater than 0.07 db. A study of Fig. 2 will show that copper wire .104 inches in diameter with a transmission equivalent of 0.067 db will meet this requirement.

The last example is that of a toll circuit, such as shown in Fig. 1, which is 40 miles long and having a repeating coil in each end of the line (to create a phantom end circuit).* At one end of the toll line there is 3 miles of 16 gage cable and at the other end is 1½ miles of 19 gage cable. The open-wire portion of this circuit consists of 35.5 miles of .104 copper wire. How much additional 19 gage cable can be inserted in this circuit and yet keep the transmission loss within the allowable limit of 9.0 db?

The present transmission loss of the toll circuit is computed as follows:

2	Repeating Coils @ 0.7 db each	1.4	db
3	Mi. 16 Ga. Cable @ 0.74 db per mi.	2.22	db
1½	Mi. 19 Ga. Cable @ 1.19 db. per mi.....	1.785	db
35½	Mi. .104 Copper @ 0.067 db per mi.	2.3785	db
		7.7835	db

Since the maximum loss for this type of circuit has been set at 9.0 db, as shown in Fig 1, it will be found upon subtracting the present loss of the circuit from the maximum allowable loss, or 9.0 db minus 7.7835 db, that there is a difference of 1.2165 db. This margin means that slightly more than 1 mile of 19 gage cable could be cut into this toll circuit. However, to be accurate it is necessary to divide the difference found above by the transmission equivalent of 19 gage cable or 1.2165 db divided by 1.19 db which gives 1.022 miles of 19 gage cable which may be inserted in this toll line without increasing the transmission loss above the standard set for this type of circuit.

Innumerable examples could be presented which would illustrate the many different kinds of problems involved in transmission engineering calculations. However, it is suggested to those who wish to acquaint themselves with the use of the charts accompanying this article or who desire to become adept at handling transmission computations, that they calculate the transmission loss of their present tributary trunk and toll circuits to determine which circuits exceed the standards outlined herein.

*In addition to creating a phantom circuit these repeating coils serve to preserve the "balance" of the toll connection. Repeating coils isolate the subscribers' plant from the toll plant reducing the effects of unbalances which interfere with the intelligibility of the conversation over the connection. For that reason repeating coils should be used in all tributary trunks. Under this plan it is unnecessary to have repeating coils in the tributary cord circuits used for toll connections, unless required in the cord circuit for supervisory purposes.

CORPORATION OPENS NEW GUYMON 'PHONE EXCHANGE

Guymon, Okla.—The Western Telephone Corporation of Oklahoma has opened its new telephone exchange here. Since assuming control of the telephone properties here on August 1, 1929, the company has spent over $49,000 in improvements. This includes a fine new building with modern switchboard and other equipment and 800 miles of copper toll lines.

Cable Faults and How to Detect and Locate Them

Here Is a Very Interesting Discussion as Presented by J. W. Diest, Engineer Wisconsin Telephone Company, Milwaukee, to the Wisconsin Telephone Association at Milwaukee, August 7, 1930—This Address Created a Great Deal of Comment

Memorandum

When telephone circuits are placed in cable, a large number of circuits are confined and protected by a single lead sheath and any rupture of this sheath may result in service reactions to a large

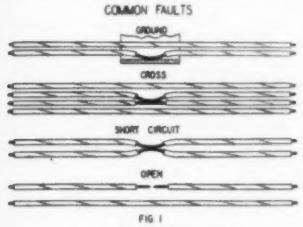


FIG 1

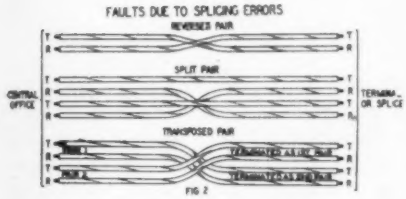


FIG 2

number of customers. For this reason it is important that cable faults be located and cleared before serious service reactions develop. This article discusses briefly methods which are practicable for use in the detection and location of the commoner faults in exchange cables, using apparatus which is or can readily be made available in the operating field.

Detecting Defective Pairs

The more common faults which are usually found in cables are illustrated in Fig. 1. A ground occurs when a wire comes into electrical contact with the sheath of the cable. This electrical contact may be due to actual mechanical contact between the wire and the sheath or it may be due to moisture which has entered the cable in some way and has impaired the insulation to such an extent that its resistance becomes quite low. A cross results when two or more wires come in contact with each other. A short circuit is the particular case of a cross between the two wires of the same pair. An open is, of course, a break in a wire. The faults illustrated in Fig. 1 may be found either within the sections of a cable or at splices.

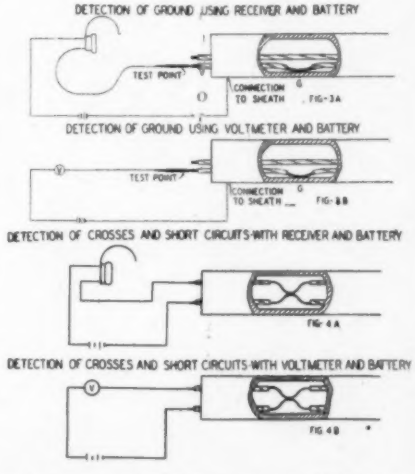
Faults Due to Splicing Errors

Certain other faults due to mistakes in splicing are shown in Fig. 2.

We shall first discuss the detection of cable faults by the so-called "continuity test" method, which makes use primarily of a telephone receiver or a voltmeter in series with a battery or a testing tone to check the continuity of a circuit for various connections.

Methods of Detecting Grounds

Fig. 3A shows the connections which are used for detecting grounds when using a battery and receiver. When testing with a receiver, one side of the battery is connected to the sheath of the cable (ground) and the other side, in series with the receiver, is connected to the wire suspected to be grounded. A click will be heard in the receiver when the grounded wire is touched with the test point. Care must be taken to distinguish between a click due to a ground and a click due to the capacity of a non-grounded wire. A capacity click will be heavy, if the cable is long, when the wire is first touched with the test point but when the wire is tapped several times in


DETECTION OF GROUND USING RECEIVER AND BATTERY
TEST POINT
CONNECTION TO SHEATH
FIG-3A
DETECTION OF GROUND USING VOLTMETER AND BATTERY
TEST POINT
CONNECTION TO SHEATH
FIG-3B
DETECTION OF CROSSES AND SHORT CIRCUITS WITH RECEIVER AND BATTERY
FIG 4A
DETECTION OF CROSSES AND SHORT CIRCUITS WITH VOLTMETER AND BATTERY
FIG 4B

quick succession the capacity click after the first one will be very slight. A ground click will be as heavy on successive tappings as on the first connection. Also a ground click is heard on the make and break of the contact whereas a capacity click is heard only on making the contact.

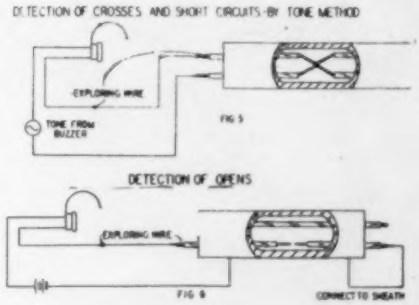
Grounds due to moisture are generally indicated by a scratching sound in the receiver when connection to the grounded wire is maintained.

Where available, it is desirable to use a voltmeter in series with the battery in place of the receiver when testing for grounds. This is especially true when the ground is due to moisture and is, therefore, not solid. The connections which are used in detecting grounds by means of a battery and voltmeter are shown in Fig. 3B. When using a voltmeter, the meter will register the full voltage of the battery applied when the test point is connected to a solidly grounded wire. If the ground is not solid, the meter will read something less than the full voltage of the battery, the reading giving an approximate indication of the resistance of the ground.

Methods of Detecting Crosses and Shorts

The methods just discussed for detecting grounds may also be used to detect crosses and shorts. It is only necessary to substitute one of the wires suspected of being crossed for the ground connection of the battery as shown in Figs. 3A and 3B. The diagrams for use in detecting crosses and short circuits are shown on Figs. 4A and 4B.

It sometimes happens that a pair will be crossed with another pair, the identity of the second pair being unknown. The best way to pick out the second pair is to use a tone and receiver. The connections for making this test are shown in Fig. 5. A diagram showing a circuit using a simple buzzer for producing tone for this test will be shown later. One side of the tone circuit is connected to the wire or pair reported to be crossed with another wire or pair. One of the receiver terminals is connected to the other side of the tone circuit and the other receiver terminal to an exploring wire. Contact is then made between the



exploring wire and other wires or pairs in the cable until one is found on which the tone is approximately the same as

when the exploring wire is connected to the suspected wire or pair. The wire or pair on which the tone is heard will be the one which is crossed with the original wire or pair. A less intense tone due to induction may be heard on other wires or pairs.

Methods of Detecting Opens

Opens are detected by the absence of an electrical circuit. Thus a wire suspected of being open, may be grounded at the distant end and then tested for a ground at the testing end as shown in Fig. 6. Failure to detect the ground will indicate that the wire is open. Care should be taken here also when using a battery with a receiver for this test to distinguish between a ground click and a capacity click.

Detecting Reversed, Split and Transposed Pairs

Reversed, split and transposed pairs are best detected by using continuity tests much the same as already described. The connections for these tests are shown in Fig. 7. To make these tests, it is generally best to first establish a talking circuit between the central office and the terminal or between the two ends of the section to be tested. Usually a good spare pair may be selected for this purpose. The tester then connects tone from a buzzer between the wire which is to be identified and ground. The other tester connects a "feeler" to one side of the talking circuit and grounds the other side of the talking pair through a condenser. Then, with a test pick connected to the end of the feeler wire he touches the wires in the terminal one at a time until he gets the tone. The tone will be heard by both the tester and helper at the same time. The helper then tells the tester the pair number and the side, tip or ring, on which he found the tone. By thus identifying the wires at the two points of termination, it is possible to detect reversed, split and transposed pairs.

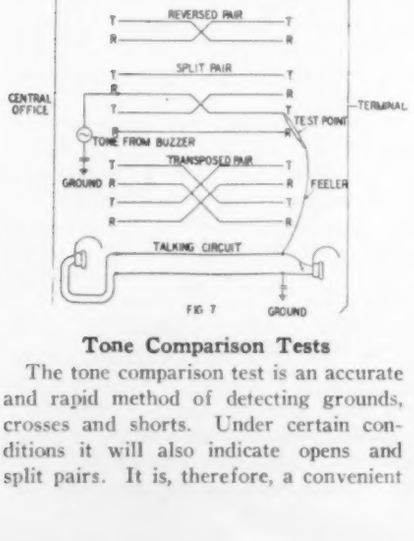


FIG 7

Tone Comparison Tests

The tone comparison test is an accurate and rapid method of detecting grounds, crosses and shorts. Under certain conditions it will also indicate opens and split pairs. It is, therefore, a convenient means for check testing all pairs in a new cable after splicing has been completed.

The test is made with an ordinary head receiver to which two equal non-inductive resistances have been added. The electrical arrangement of this circuit is shown on Fig. 8.

It will be noted that the tone comparison circuit corresponds to a part of that of the Wheatstone bridge. The resistances "A" and "B" form the ratio arms and the receiver acts as a detector when the network is unbalanced. With this arrangement an alternating current should be used. By means of tone comparison, it is possible to check the quality of two resistances, two capacities, two inductances, or any two combinations of these quantities, when the circuit is completed as shown in Fig. 9. In this diagram the 3rd and 4th arms of the Wheatstone network are shown as capacities, since it is generally various types of capacities which are compared by the tone comparison test. It will be noted that if C_1

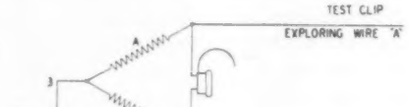


FIG 8

TONE COMPARISON TEST-COMPARISON OF CAPACITIES

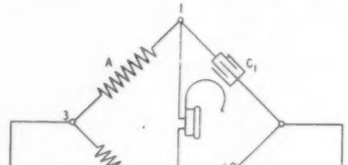


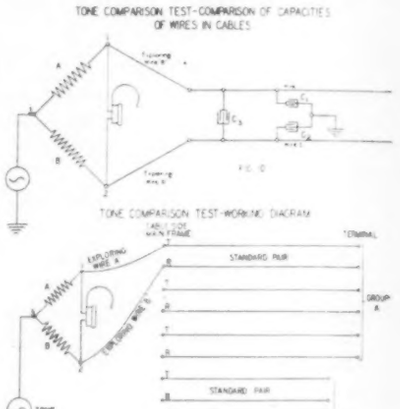
FIG 9

equals C_2, no current will flow through the receiver but if C_1 and C_2 are not equal, a tone will be heard in the receiver, the strength of this tone being dependent upon the degree of difference between C_1 and C_2. This is the general principle used in all tone comparison tests.

As applied to testing cable pairs, it is known that each wire in a cable has capacity to all the other wires and to the sheath. This capacity, known as the ground capacity, will be different for wires of different lengths. Two wires electrically connected (crossed) will have a much higher capacity than a single wire. Therefore, cable conductors may be substituted for the condensers (capacities) shown in Fig. 9, the sheath of the cable being the point common to the two condensers. This arrangement is shown in Fig. 10. It will be noted that the capacities C_1 and C_2 in Fig. 10 are the capacities of wire 1 and wire 2 to ground. The capacity C_3, from wire 1 to wire 2, has no effect on the balance since it merely shunts the receiver.

Method of Making Tone Comparison Tests

Fig. 11 shows the connections to be used in making tone comparison tests. The resistances "A" and "B" are generally of about 1,000 ohms each and should be comparatively closely balanced. The



tone is furnished by any convenient means available. Fig. 12 shows a suggested connection for supplying tone for any of the tests described in this paper, using any available buzzer and a magneto type telephone induction coil. The condenser shown bridged across the contacts of the buzzer is merely to reduce arcing and may not be necessary in all cases. The condenser in series with the output leads is used to keep direct current from the buzzer battery from getting onto the circuits under test.

Referring to Fig. 11, exploring wire "a" is connected to one side of a pair which, for the purpose of this test, is regarded as a standard conductor. Exploring wire "b" is then connected to the ring side of the same pair. The tone from a buzzer is connected to terminal 3 and ground. If the capacity of the tip side is equal to that of the ring side, no tone will be heard in the receiver. Exploring wire "b" is then connected to the tip side of pair 2, then to the ring side of pair 2 and so on to include all of the conductors in the group which contains the standard pair. If no tone is heard in the receiver in any of these tests it may be assumed that the pairs tested are free from crosses, grounds, or shorts. If a tone is heard it is probable that the wires on which unbalances were noted are defective, or at least are not like the standard wire.

The standard pair should be of the same gauge and must be of the same length as the other pairs which are con-

(*Continued on page* 50.)

The Unit of Transmission

B. C. Burden Here Gives Us the Definition and Importance of the DB (Deci-bel) in Transmission—This Article Is so Interesting and Instructive that It Should Be Filed for Future Reference

General

In the August and September issues (1929) of TELEPHONE ENGINEER, the writer discussed the general theory underlying telephone transmission. This subject is of sufficient importance to warrant further discussion and amplification of the principle points and especially of the unit of transmission itself.

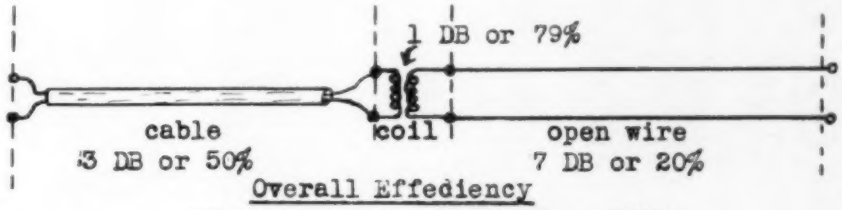
In the small exchange, transmission problems are for the most part simple, as the subscribers' loops are relatively short and there is no inter-office trunks to be considered. Nevertheless a knowledge of the various factors which control overall transmission is of value even to the small exchange manager as "transmission judgment" must be exercised in the purchase of subscribers' sets, in the use of phantom coils, and in knowing how far the rural leads leaving town can be carried in cable without transmission difficulties. A large number of telephone companies are still using No. 22 gauge cable for local loops when No. 24 gauge would be just as satisfactory and considerably cheaper.

In order to properly appreciate and understand transmission theory and problems it is necessary at the outset that a proper conception of the unit of transmission, the DB, be had.

The DB (Deci-bel)

The transmission efficiency of telephone circuits and equipment is expressed in terms of a unit known as the DB (deci-bel). This unit was assigned to represent the loss or gain between two amounts of power having a ratio of $10^{.1}$. If we raise 10 to the one-tenth power we find that the ratio expressed decimally is .794 for losses and 1.259 for gains. In other words, if we have an input of 1 watt to a line and take out .794 watts at the output end, then we can say that the line has a loss of 1 DB. If we wish to talk in terms of per cent we would say that the efficiency of the line was 79%—i. e., we got back 79% of the power put into the line, the other 21% being dissipated in the circuit.

The question immediately arises, "Why confuse the issue by dragging in a new term; why not call it per cent in expressing the efficiency of a circuit?" It would be possible to use percentage in determining and expressing the efficiency of transmission over telephone circuits, but this method would be very cumbersome as compared to the use of the DB system. If percentage was used it would be necessary to multiply the efficiency in per cent of each unit by that of the next unit in order to obtain the overall efficiency in per cent. This would involve a great deal of work and result in large numbers with consequent chances of errors being introduced in the computation. However, with the DB system it is only necessary to know the loss or gain of each unit and they can then be added algebraically together to get the overall efficiency. See figure 1 for illustration of two methods. If it is desired to express the overall efficiency in terms of ratios or per cent the total number of DB's can quickly be converted by means of a simple equation or by means of tables similar to the one shown in figure 3.



DB method—3 + 1 + 7 = 11 DB or .079%
% method—50 × 79 × 20 = .079%

Fig. 1.—Computation of efficiencies by DB's and by Per Cent

A proper understanding of the mechanics of the DB unit is difficult for many because they fail to grasp the fact that the unit in itself does not represent any given amount of power, but is only an expression for the ratio of input and output powers which may be of any magnitude. Stating it different, we might say that the DB represents a fixed reduction or increase (depending upon whether it is loss or gain) in power regardless of what the character of the power source is, or the magnitude of the input power. *The DB might aptly be termed a "logarithmic percentage."* We will, however, see later in this article where the DB by association with a reference base does signify a definite value of transmission.

The DB unit, while originated primarily for use in telephone transmission problems, could just as readily be applied to other lines of endeavor and in fact some use of this unit in the sound field has already been considered.

Figure 2 illustrates the fact that the magnitude of the input voltage or power has no effect on the unit of transmission.

Basic Equations for Computing DB's

The DB was defined as the loss or gain of input and output powers differing in the ratio $10^{.1}$. From this basic definition we may derive the following equations for finding the number of DB's when the power, current, or voltage ratios are known:

No. 1.—Equation for finding DB's when power ratios are known:

$$DB = -10 \log_{10} \frac{P_r}{P_s}$$

where: P_r is power output.
P_s is power input.

No. 2.—Equation for finding DB's when current ratios are known:

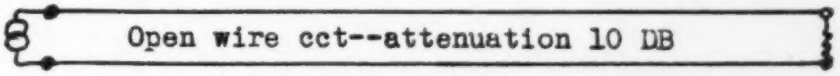
$$DB = -20 \log_{10} \frac{I_r}{I_s}$$

where: I_r is current output.
I_s is current input.

No. 3.—Equation for finding DB's when voltage ratios are known:

$$DB = -20 \log_{10} \frac{E_r}{E_s}$$

where: E_r is voltage output.
E_s is voltage input.



Case No. 1—Input 10 watts—Output 1 watt = 10 DB
Case No. 2—Input 1 watt—Output .1 watt = 10 DB

Fig. 2.—Value of DB independent of input power

You will note that in the equation for current and voltage ratios that the log is multiplied by 20 instead of 10 as in the case of power ratios. This takes

care of the squared relation between power and current or voltage, i. e.:

$$P = I^2R, \quad P = \frac{E^2}{R}$$

It is essential in considering current or voltage ratios that the impedance at the input and output ends be the same or the answer obtained with equations No. 2 and No. 3 will be in error. If the impedances are not the same, the equations can be changed to the following form and used with accuracy:

$$DB = -20 \log_{10} \frac{I\sqrt{Z_r}}{I\sqrt{Z_s}}$$

$$DB = -20 \log_{10} \frac{E_r/\sqrt{Z_r}}{E_s/\sqrt{Z_s}}$$

The following examples illustrate the use of the above equations:

Example No. 1.—If ten watts is applied to the input of a line and five watts is available at the output terminals, what is the loss of the line in DB's?

$$DB = -10 \log_{10} \frac{5}{10} = 10 \times (9.699 - 10) = 3.01 \text{ DB's.}$$

Example No. 2.—If .01 amperes is measured at the sending end of a line and .0025 amperes at the receiving end, what is the loss of the circuit in DB's?

$$DB = -20 \log_{10} \frac{.0025}{.01} = 20 \times (9.398 - 10) = 12.04 \text{ DB's.}$$

When the number of DB's is known and it is desired to find the power or current ratios, the following equations are useful:

Equation No. 4.—Equation for finding power ratio when DB's are known:

$$\frac{P_s}{P_r} = \text{anti-log} \left(\frac{DB's}{10} \right)$$

Equation No. 5.—Equation for finding current ratio when DB's are known:

$$\frac{I_s}{I_r} = \text{anti-log} \left(\frac{DB's}{20} \right)$$

The following table made up from the equations given shows at a glance the current and power ratios for any number of DB's up to 30, also the efficiency of energy transmission in per cent.

DB Table

You will observe from this table that a loss of three DB in a circuit will decrease the power at the receiving end 50%. If the loss is increased to 6 DB the power received will be reduced to 25%.

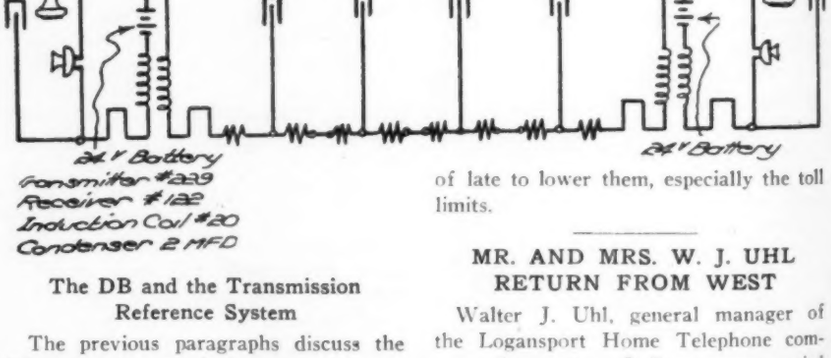
In using the formula $DB = -10 \log_{10} \frac{P_r}{P_s}$, if the power at the sending end (P_s) is greater than that at the receiving end (P_r) the power ration will be a fraction and the answer will have a positive sign indicating a loss; if P_r is greater than P_s the power ratio will be a whole number and the answer will have a negative sign.

CUT OUT AND SAVE

DB's	Power Ratio P_r/P_s	Current or Voltage Ratio I_r/I_s or E_r/E_s	Power Efficiency in %
1	.794	.891	79
2	.631	.794	63
3	.501	.708	50
4	.398	.631	40
5	.316	.562	32
6	.251	.501	25
7	.200	.447	20
8	.157	.398	16
9	.126	.355	13
10	.100	.316	10
11	.079	.282	8
12	.063	.251	6
13	.050	.224	5
14	.040	.200	4
15	.032	.178	3
16	.025	.158	2.5
17	.020	.140	2.0
18	.016	.126	1.6
19	.013	.112	1.3
20	.010	.100	1
21	.008	.089	.8
22	.006	.079	.6
23	.005	.071	.5
24	.0039	.0631	.39
25	.0032	.0562	.32
26	.0025	.0501	.25
27	.0020	.0447	.20
28	.0016	.0397	.16
29	.0013	.0355	.13
30	.0010	.0316	.10

NOTE.—To obtain ratio for gains for either power or current, take reciprocal of loss ratio. For example, 1 db = .794 loss ratio or $\frac{1}{.794} = 1.259$ gain ratio.

Fig. 3—DB Table



The DB and the Transmission Reference System

The previous paragraphs discuss the DB merely as a unit for expressing the effect of circuits or apparatus in reducing or increasing the power passing through them.

In considering the problem of telephone transmission, we are concerned mainly with the quality and quantity of sound we deliver to the listening subscriber's ear. Circuits and equipment must be designed so that satisfactory conversation can take place on any connection. In order that standards might be set up which would stipulate limiting losses allowable on local and toll connections, a standard reference system was established. Figure 4 shows the schematic of this reference system. It consists essentially of two common battery subsets connected by an artificial line through a repeating coil. This reference system was developed when the mile of standard cable (19 gauge) was the unit of transmission, therefore the artificial line was designed to simulate 32 miles of 19 gauge cable. For purposes of explaining the relation between the standard reference system and the DB, we will consider the artificial line as consisting of a resistance network having a total attenuation of 30 DB and being adjustable in 1 DB steps. The mile of standard cable unit is 6% larger than the DB unit.

When the standard reference system was first set up it was found that satisfactory volume would be obtained on toll calls, provided the volume in the listening receiver was equivalent to that in the receiver of one of the standard subset when 30 DB was inserted in the artificial line and with someone talking in a normal tone in the other standard subset. Likewise, they found that a volume equivalent to that obtained over the reference circuit with 20 DB cut in would be satisfactory on local calls. The early standards established was therefore regarded as 30 DB (limit) for toll calls and 20 DB (limit) for local calls. These limits still stand, although there is a tendency of late to lower them, especially the toll limits.

MR. AND MRS. W. J. UHL RETURN FROM WEST

Walter J. Uhl, general manager of the Logansport Home Telephone company, Logansport, Indiana, accompanied by his wife, returned recently from California, where they spent the past two months. April 1st Mr. Uhl asked for a six months' leave of absence and, accompanied by Mrs. Uhl, spent the month of April in Florida. Returning from there, they left for Alaska, where they spent some time. On their return they stopped in California for an extended visit. Walter is back on his job and will be in Chicago to attend the convention.

Trunk Circuit and Features

This Is the Fourth Installment of a Series of Articles by Mr. John H. Levis. Telephone Engineer, Rochester, N. Y. Particular Attention Is Called to the Diagram of a Straight Forward Trunking Circuit Shown on Pages 30-31

In this installment of the article on "Straightforward Trunking" it is necessary to show the diagram of the system as designed by Stromberg-Carlson, and also the features contained therein so that the diagram may be referred to in subsequent installments in which each feature will be explained.

The diagram as illustrated on pages — and — shows the following features contained in the Straightforward Trunking Circuit:

(1) Repeating coil condenser type transmission circuit.
(2) Single lamp (per trunk).
(3) Flashing incoming signal.
(4) Two tone call, passing signal.
(5) Relay automatic operator cut-in.
(6) Emergency key listening. (Individual per trunk.)
(7) Pre-select ringing. (Master control.)
(8) Four party harmonic master key control.
(9) Single reverting busy tone master key control.
(10) Machine ringing.
(11) Audible ringing signal. (Monotone.)
(12) Audible busy test.
(13) Incoming calls with trunk plug in line jack.
(14) Operator overlap ringing select or reverting busy.
(15) Non-overlap with plug in line when pre-selecting.
(16) Steady lamp on "A" disconnect.
(17) Relay sequence cut-in of operator.
(18) Sequence relays continuity lamp indicators.
(19) Peg Count Circuit.
(20) Non-ring or re-establishing Master Key Control.
(21) Advance traffic indication control.
(22) Instantaneous generator cut-off.
(23) Recalls from intercepting desk.
(24) Advance traffic pilot.
(25) Night Alarm.
(26) Listening key cut-in for supervising purposes.
(27) Operator's cut-in and peg count pilot.
(28) Relay flash circuit.
(29) Single 3 conductor plug.
(30) Sequence control circuit.

The features outlined above cover the complete trunk circuit and common equipment functions.

The circuit shows each relay in the trunk circuit proper and in the common circuits with a designation or a number. These numbers and designations will be used and referred to in the actual circuit description, in the detail function of each relay in the trunk circuit and in the common circuit description which will follow.

Each feature listed above and the general circuit operations will be described in subsequent articles. In view of this it will be necessary to refer from time to time to the circuit diagram of the Straightforward Trunk Circuit.

Reference will also be made to the circuits and circuit descriptions of the outgoing office circuits that apeared in the September, 1930, issue of Telephone Engineer.

In order that some of the features listed above will be better understood, especially in reference to the trunk keyboard layout, the July, 1930, issue of Telephone Engineer should be reviewed.

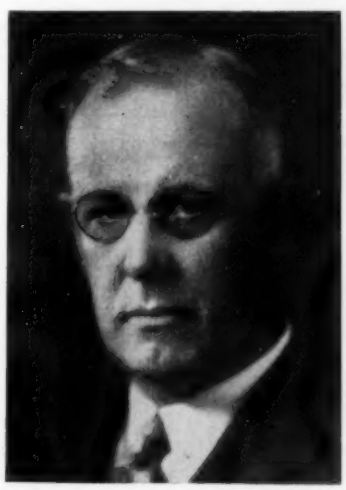
See diagram on pages 30-31.

JAY G. MITCHELL APPOINTED TO IMPORTANT POST

Jay G. Mitchell, who first entered actively into the telephone industry in 1893 as a student inspector, and who for the last year has been with the Associated Telephone Utilities Company System, has been made general commercial superintendent of that organization, covering central and eastern groups. The Associated Telephone Utilities Company is now said to be the largest operator of Independent telephone properties in the United States.

With the exception of a few years devoted to engineering and the development and marketing of storage batteries and storage battery electric automobiles, Mr. Mitchell has been engaged in the telephone industry since he first entered the employ of the Cleveland Telephone Company thirty-seven years ago.

His experience includes every branch of the operation of telephone property, the design and marketing of telepehone equipment, including modern high efficiency mechanical switching apparatus, and the valuation of telephone properties as a part of the establishment of adequate revenue, to support security issues, and other purposes.



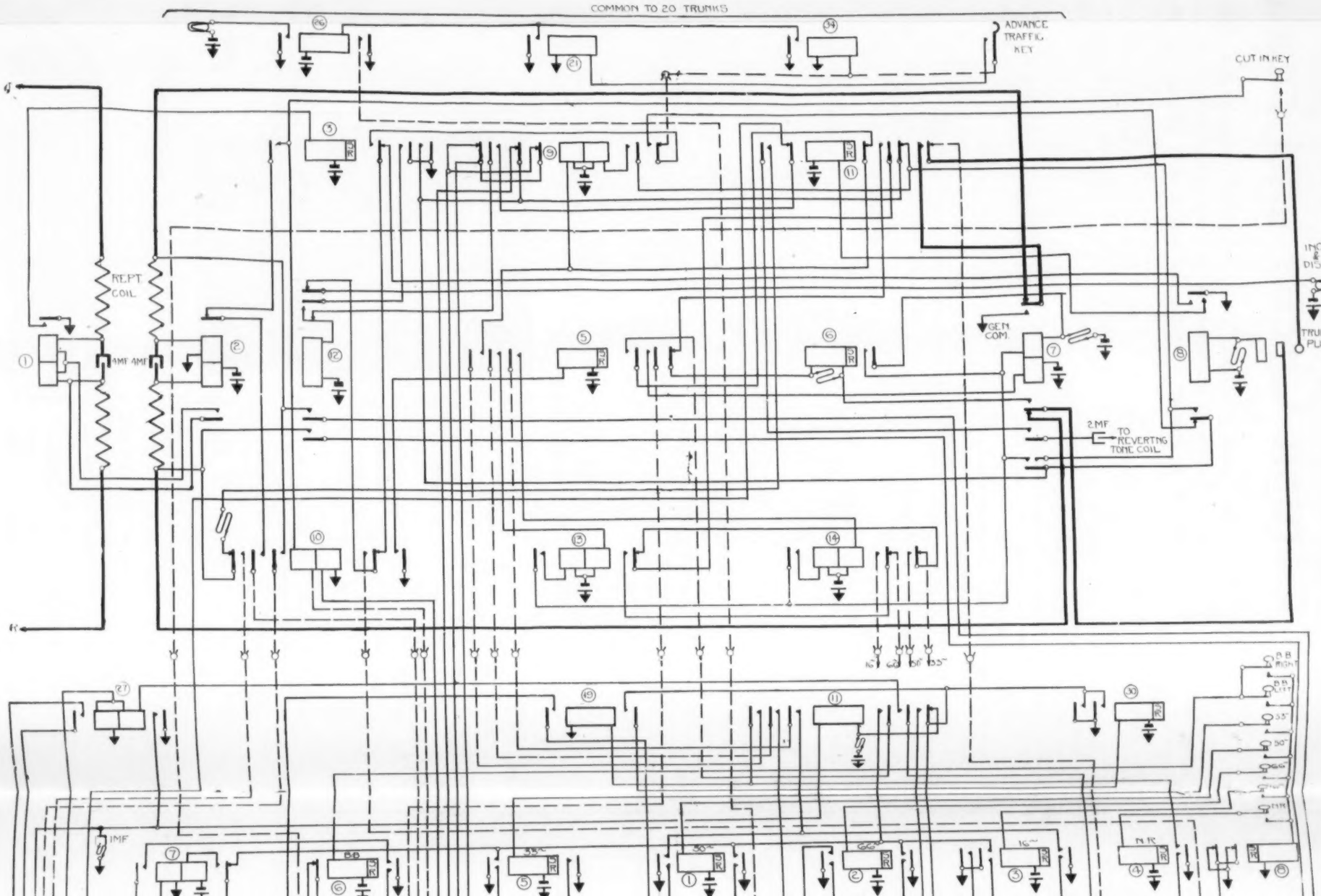
Jay G. Mitchell

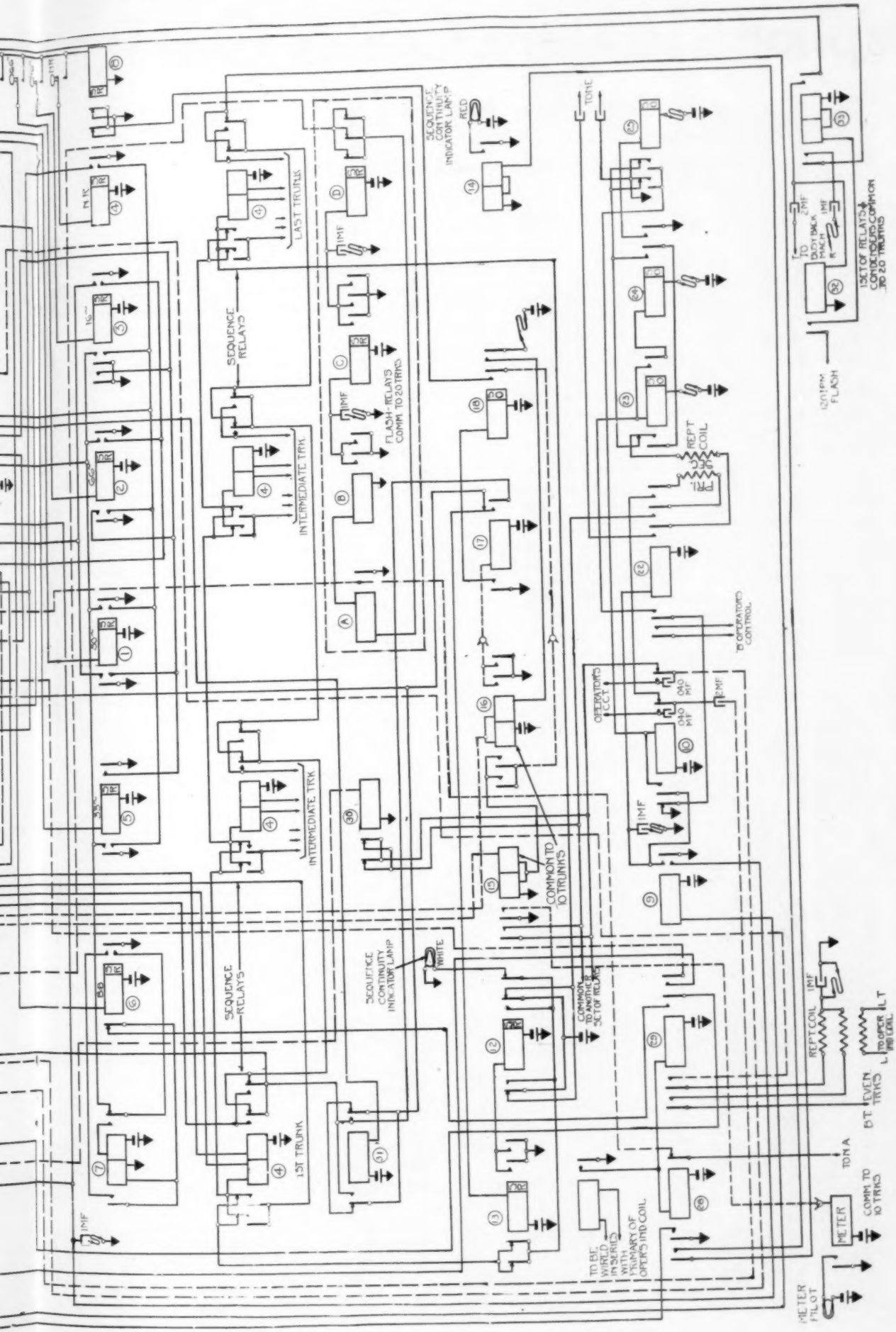
For eight years prior to going with the Associated Telephone Utilities company Mr. Mitchell was secretary-manager of the Illinois Telephone Association with offices in Springfield, Ill. Before that he was connected with the engineering firm of McMeen & Miller, Chicago, from 1914 to 1918. In 1918 he was appointed telephone engineer of the Illinois Public Utilities Commission, the predecessor of Illinois Commerce Commission, later becoming consulting engineer for the commission. He is the author of "Principles and Practices of Telephony" in five volumes published by the McGraw-Hill Book Company.

Convention Schedule

Illinois Telephone Association, Pere Marquette Hotel, Peoria, Nov. 12 and 13.
Missouri Telephone Association, Hotel President, Kansas City, Nov. 18 and 19.
Canadian Independent Telo. Association, Prince George Hotel, Toronto, Nov. 25 and 26.
South Dakota Telephone Association, Sioux Falls, Jan. 13, 14 and 15, 1931.
Nebraska Telephone Association, Lincoln Hotel, Lincoln, February 10, 11 and 12, 1931.
Texas Independent Telephone Association, Fort Worth, Texas Hotel, March 17, 18 and 19, 1931.
Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, April 7, 8 and 9, 1931.

Diagram of Complete Straightforward "B" Trunk Circuit. Article Explaining Its Various Features on Page 29




SEQUENCE RELAYS
LAST TRUNK
INTERMEDIATE TRK
FLASH RELAYS COMM TO 20 TRKS
SEQUENCE CONTINUITY INDICATOR LAMP
RED
TONE
TO OPERATORS CONTROL
OPERATORS CCT
REPT COIL
1 SET OF RELAYS CONNECTED PER 20 TRUNKS
TO 1ST BACK BOARD
CONTROLLED FLASH
SEQUENCE RELAYS
INTERMEDIATE TRK
SEQUENCE CONTINUITY INDICATOR LAMP
WHITE
COMMON TO 10 TRUNKS
COMMON TO ANOTHER SET OF RELAYS
1ST TRUNK
TO BE WIRED IN SERIES WITH SECONDARY OF OPERS IND COIL
REPT COIL
TO OPER IND COIL
BT EVEN TRKS
TO N A
METER
COMM TO 10 TRKS
METER PILOT

Telephone Industry Carries On

Annual Survey Shows Large Utilities Will Carry Burden of 1930-31 Appropriations Which Again Near One Billion Dollar Mark

The telephone industry isn't standing still during 1930. It is pushing forward to the tune of approximately one billion dollars. This is the amount which the industry has set aside for improvements and construction during the next twelve months, according to replies to a nation-wide query sponsored by TELEPHONE ENGINEER and sent to telephone companies over the country.

The results of this year's survey compared most favorably with the TELEPHONE ENGINEER survey of 1929. However, it was apparent that whereas last year, small companies were exerting every resource to plunge ahead, thus adding considerably to the list of figures which totaled up near the billion dollar mark, this year it is the larger telephone companies which are carrying the burden of the billion dollars of appropriations. Fortunately for the industry, the large companies have added to previous appropriations, thus atoning for the decline in appropriations of smaller companies, as compared to last year.

True to the promises made to President Hoover a little less than a year ago when heads of public utilities met with him in Washington to discuss the stock market crash and the resulting business depression, the large telephone companies have enlarged their improvement program, and building in these circles is going forward in a far greater measure than in the last few years, except 1930 of course.

The American Telephone and Telegraph Company alone is placing orders for future deliveries of raw materials amounting to $700,000,000, which will be spread over the seventeen Bell companies.

Although figures were not obtainable for each individual company, the Chesapeake and Potomac Telephone group of companies in the Bell System plans to spend a total of $18,821,000; the Southern Bell Telephone and Telegraph Company will spend $33,000,000 on gross construction; and the expenditures of the Southwestern Bell Telephone Company in Missouri, Arkansas, Oklahoma and Texas will reach the sum of $41,967,000, it is estimated. Thus the total gross construction expenditures alone of these three companies of the Bell System operating in the southern states will amount to $93,788,000. This figure is more than $9,000,000 higher than last year's expenditures in the same territory.

And the South does not have exclusive priveleges of the Bell pocketbook. Up in Michigan $28,000,000 has been estimated as the amount necessary to carry out their 1930-31 expansion program. Directors have already approved the expenditures of $18,919,000 by the Michigan Bell Telephone Company, and have indicated that the remaining amount likewise will receive approval.

The Pennsylvania Bell Telephone Company has announced that construction of a central office structure in Philadelphia will be started immediately, which when completed will represent an investment exceeding $3,000,000. A one million dollar building has been scheduled by the New Jersey Bell Telephone Company for Newark, N. J.

The small state of West Virginia, whose operations are guided by the Chesapeake & Potomac Telephone Company, is scheduled for $333,000.00, during the year, most of which will be expended for extensions, underground cable and conduit, pole lines, etc.

Official figures for improvements outside of construction, were not obtainable for any company save that of Michigan. However, all indicated that their total expenditures would not be below the $15,000,000 mark, and many will soar beyond that figure.

The largest figures mentioned by any Independent company were given out by Marshall E. Sampsell, president of the Associated Telephone Utilities System, who said the system's 1930 construction budget for service extensions and improvements has been increased forty per cent, to a total of $7,000,000.

The increased budget, he said, was made necessary by the addition of new companies to the system and by the growth of the territory served. Approximately $3,853,000 will be divided among the Illinois Commercial Telephone company, Commonwealth Telephone company in Wisconsin, Kansas State Telephone company, Michigan State Telephone company, and groups of companies in Indiana, Iowa, Missouri, Ohio, Pennsylvania, and New York.

The survey of Independent telephone companies was conducted by states and results indicated that Missouri was in the lead and showing the rest of the world what she thinks of the financial depression by investing about $700,000 in the telephone industry this year.

Of this amount the Mid-West Utilities company, with headquarters in St. Louis, Mo., is responsible for $175,000 which has been set aside for general re-habilitation of the various plants, including three contemplated new switchboards. This amount does not include extensions and purchases, of which no accurate figures could be obtained.

The Scotia Telephone company, also of St. Louis, contemplates expenditures totaling $85,000 during the next twelve months, $12,000 of which will go for land and new buildings, $15,000 for aerial cable construction, $5,000 for underground cable construction, $1,000 for clay conduit construction, $2,000 for pole line hardware, and $1,800 for substation protection.

The balance will be used toward installation of three new switchboards, new extensions, toll lines, poles, wire, and batteries. This surpasses last year's expenses for improvements by the Scotia company by $35,000.

Ohio ranks second to Missouri in expenditures for the next 12 months, with Wisconsin third and Pennsylvania fourth.

Lorain, Ohio, is scheduled for improvements amounting to $60,000 and tops the list of expenditures of any one Ohio Independent company reporting. Yet last year the Lorain Telephone company spent near to $300,000 on improvements. Of the $60,000, $10,000 will go for installation; $40,000 for underground cable construction; and $10,000 for clay conduit construction.

The Star Telephone company of Ashland, Ohio, will spend $25,000, according to Charles W. Good, president of the company, and the Western Reserve Telephone company of Hudson, Ohio, plans to spend $10,000.

The LaCrosse Telephone Corp., at LaCrosse, Wis., has scheduled expenditures of $70,000 for their 1930-1931 budget. Marshfield is to receive additional switchboards and extensions costing $19,000, according to the report of the Marshfield Telephone Exchange.

Telephone companies in Pennsylvania planning the most extensive improvements are the Northeastern Pennsylvania Telephone company of Forest City, Pa., which plans to spend $50,000, including $4,000 for land and buildings, and $10,000 for wire and the Denver & Euphrata T. & T. Co., of Euphrata, Pa., which will spend $25,000.

(*Continued on page 57.*)

National Telephone Convention Next Week

Gathering of Telephone Industry Brings Representatives From the Four Corners of the Earth—Stevens Hotel, Chicago, Place of Meeting and October 14-15-16 and 17th the Dates

In this week's TELEPHONE ENGINEER we publish an announcement by the United States Independent Telephone Association of the Thirty-fourth Annual convention of the Independent telephone group, which will be held at the Hotel Stevens, Chicago, October 14th to 17th. The Association announces that the main topic for discussion during the convention will be the advantages and disadvantages of the operation of toll lines by Independent companies, including a discussion of the expense of construction and maintenance of these lines. This topic is scheduled for the morning of Wednesday, the second day of the convention. It will be followed in the afternoon by the annual meeting of the Plant Division, at which Mr. A. L. Stadermann of Terre Haute, Indiana, chairman of that division, is to discuss "the Transmission Qualities of Wire and Cable" and the use of the new transmission unit. This, in some respects, will be a repetition of the fine address Mr. Stadermann gave at the recent Class A conference.

The meeting of the State Association executives which, in recent years has been held on the evening of the first day of the convention, has been changed to the morning of the 17th so as to enable the State Association men to have more time for the discussion of their mutual problems. The topic this year will be "Co-operation Between State Associations."

The traffic division is also varying its program by arranging to visit the offices of the Illinois Bell traffic department in Chicago where representatives of that company are to explain the Illinois Bell methods of employment and instruction of operators, including visits to the toll room, a manual office, a dial office and inspection of such special equipment as telephoto. The accounting division is to resume its discussion of the proposed changes in the accounting classifications. The Program Service Association will present for the benefit of its members the recent developments in Program Service equipment. The commercial division is also varying its program by arranging for a comprehensive study of conditions throughout the country through a series of reports from the various district chairmen of the division. This should prove a very interesting session. In order to enable some to attend both the plant or accounting and the commercial division conference the commercial division program has been set for the morning of Thursday, the 16th, while the accounting, plant and traffic will meet on the afternoon of Wednesday, the 15th, and the Program Service on the morning of the 17th.

The final event on the program is a lecture and demonstration by Sergius P. Grace of the Bell Telephone laboratories on the latest developments and discoveries of the laboratories. This will be given at 1 o'clock on Friday, the 17th, at a luncheon by the Illinois Manufacturers' association, to which all those in attendance at the telephone convention are invited. Special arrangements have been made for the telephone people to have special tables. Those who heard Mr. Grace two years ago at the series of demonstrations he made before the State conventions will be anxious to hear him again and learn of these latest discoveries.

Over forty manufacturers and supply dealers have reserved space in the exhibit hall, thus insuring a large exhibit and of course an interesting one.

Reduced railroad rates have been arranged on the certificate plan which has been followed for a number of years. By use of this plan any member or visitor can obtain one and one-half fare for his round trip. The association, in notifying the telephone companies of the reduced rate, says:

"A rate of one and one-half fare on the certificate plan has been agreed to by all the railroads (except from points from which the fare to Chicago is less than sixty-seven cents). Under the certificate plan the person purchasing a ticket pays the full one way fare at the time of purchase and obtains from the railroad agent selling him the ticket a certificate setting forth the number of his ticket, the name of the purchaser, the date, etc. This certificate when deposited and validated at the convention entitles its owner to purchase his return ticket, via the same route followed in going to the convention, for half fare. Agents at larger points are supplied with these certificates but those at small stations sometimes are not, therefore it is

(*Continued on page* 38.)

A Telephone Pioneer

By Ray Blain

Now that I'm old, and hobble
  Thru the office on a cane.
My working days just memories,
  With now and then a pain.
Please have a cozy chair placed near
  Some busy selector bays
And to the clatter of the switches,
  Let me dream of other days.

Days before the automatic
  When magneto was our speed,
But to give subscribers service
  Was even then our faithful creed.
Trouble, sure we had a plenty
  Of the deep elusive kind
For with testing methods faulty
  It was always hard to find.

How we fought the sleet in winter
  Maintaining leads of open wire;
Struggling hard from early morning,
  Snatching lunch, side a small camp fire,
Spending nights with kindly farmers,
  Perhaps sleeping on the floor,
To be near our work tomorrow
  The quicker service to restore.

Although hardships they were plenty
  There was great love for the game
Which today has changed so greatly
  To me will never seem the same.
Changes yes, but for the better
  To maintain our faithful creed—
Better service for subscribers
  Younger men must fill the need.

LINE AND DESK

HELPFUL HINTS ON SPRINGS FOR TELEPHONE APPARATUS

The many types of springs necessary to fill the manifold needs of telephone apparatus comprise both non-ferrous and steel springs, of sheet metal and of wire. Proper functioning of all these can be ensured only by care in their design and in the selection of their material. In many instances springs must occupy but small space, yet must maintain delicate adjustment, with a minimum of attention, throughout the life of the apparatus. The forces on springs are sometimes large, and space limitations require that the springs operate under comparatively large unit stresses.

By far the most numerous are the sheet non-ferrous springs, usually consisting of punched and formed parts made from brass, nickel-silver, or phosphor bronze. Some are employed statically—to maintain constant pressure for long periods—but more are subject to successive deflection, electro-magnetically or mechanically. The latter are essentially cantilever springs, clamped at one end; they are used in switchboard keys, subscribers' dials, relays, jacks, interrupters and switches. The fixed end is customarily clamped between strips of phenol fiber, a good insulator, mechanically strong, and permanent in form. When used as contacting members, they bear one or more precious-metal contacts spot-welded in place near the operating end. The precious-metal contacts are employed to reduce contact resistance and the destructive effects of arcing when circuits are broken. When used as brushes or wiping members, the spring material itself usually serves for the contacting and wearing parts. To springs that form part of electrical circuits, the connections are soldered, usually to lugs which form part of the spring and project from it at the end of the clamped area opposite its operated end.

The properties required of these small springs are numerous and vary for each type of application. The proportional limit* must not be too high to prevent adjusting the spring by flexing it with a tool to the point where it takes a set and occupies a position in which it provides the desired operating pressure. In other words, there must be room enough to flex the spring to the point where it will take a set within the space provided. A spring of high proportional limit, such as one of clock-spring steel, may be bent nearly double without being permanently deformed.

The modulus of elasticity should be within the range of twelve to twenty million pounds per square inch in order that the load-deflection rate will not be too steep to permit reasonable ease of adjustment by hand.

If telephone-apparatus springs were not carefully designed to have as large a factor of safety as possible, there would be numerous cases of fatigue failure. All metals thus far investigated have an "endurance limit," a maximum stress which may be repeated indefinitely without failure. A stress above this limit, if repeated often enough, will lead to eventual failure. The effect is cumulative and the failure occurs quickly in seemingly sound metal that has functioned satisfactorily for years. Only recently, after completing a few preliminary fatigue tests on sheet metal, has the full significance of this property been realized. It has been shown that the ratio of the endurance limit to the ultimate tensile strength varies from .15 to .36 for brass, nickel-silver and phosphor-bronze sheet, and that for steel the ratio varies from .40 to .60. It is important, therefore, to know the endurance limit of non-ferrous sheet-metal springs in order to determine whether a design provides a sufficient margin of safety.

"Creep," or deformation under sustained load, must not take place, since the material will lose tension. Brass, nickel-silver, and phosphor bronze may be expected on the basis of years of experience to hold adjustments when stressed up to approximately their proportional limits. Other materials when considered for telephone apparatus springs are investigated to determine their "creep" characteristics.

Spontaneous failure of a metal under prolonged stress, takes place with some brasses under high sustained stress and severe atmospheric conditions, and therefore springs that are required to hold their pressure for long periods under these conditions are not made from this material. Nickel-silver will also fail under still higher sustained stress and more severe corrosive conditions; phosphor bronze is least susceptible of all. In designing these springs, generous fillets and easy curves are employed to prevent the building up of localized high stresses that may lead to failure under sustained load and fatigue failure under repeated flexure.

When springs are used as wipers in electrical circuits where arcing can occur, brass and nickel-silver are not employed because the heat of the arc breaks down the material, volatilizes the zinc, and disintegrates the spring. For springs so used, phosphor bronze, which does not contain zinc and has wear resistance superior to brass and nickel-silver, is therefore employed.

Springs must also be resistant to atmospheric corrosion and capable of readily alloying with soft solder. Nickel-

*The proportional limit is the stress beyond which deflection is not proportional to stress.

THE WAY TO USE THE TELEPHONE

By Oliver Allstorm, Bell Telephone News

Take receiver
Call for number;
When you get it
Don't you slumber!
There, you got it. Now be ready,
Give your name and then hold steady.

There's your party, now begin it,
Be as brief as any minute.

"Brown is talking." That's it, say it;
Use your voice and don't delay it.

'Phones for service are a blessing,
But for "gossip" they're distressing!

Everybody's got to use them,
You and I should not abuse them.

Cut out "gossip" and "debating,"
Think of others who are waiting.

Think of others, patient, nervous,
Praying for some urgent service.

Think of them, and spare the worry,
That's the way to 'phone, so hurry!

Say your say,
And don't repeat it.
Then, when through—
"Hang up" and beat it!

silver is superior to brass in its mechanical properties, and may be readily spot-welded; as a result of years of experience it has been found that springs made of this material are capable of maintaining adjustment in a satisfactory manner in service. Phosphor bronze has still greater wear resistance than brass or nickel-silver and superior spring properties.

Springs of clock-spring steel are used as vibrating elements in interrupters, where a high fatigue endurance is required, and for springs that must be worked at high pressure and rapid build-up of pressure. These springs are made from carbon-steel, heat-treated and then cold-rolled, and are by nature brittle. To guard against excessive brittleness and at the same time provide a high strength, a bend test has been developed. It requires that when the material is bent back parallel to itself to form a "U" and further compressed between flat parallel surfaces (for example, between the jaws of a vise), the material shall not break when compressed a certain distance but must break when compressed further. The test can be conveniently applied by drawing the looped material through two of a series of graduated slots.

Tinned and plated music wire is extensively used for compression springs in telephone apparatus. Here the spring is in the form of an open helix, and is either tinned or plated with nickel. The average tensile properties of the music wire employed are: proportional limit, 217,000 pounds per square inch; ultimate tensile strength, 350,000 pounds per square inch. No chemical or tensile requirement is placed on this wire, the main feature of concern being brittleness. The elongation measured in an eight-inch length must be between one and four per cent for heavy wire (up to and including No. 27 gauge) and one-and-one-half to seven per cent for No. 28 gauge wire and lighter. A kinking test, in which No. 30 wire and smaller shall kink without breaking, also indirectly controls its tensile properties.

Vast quantities of springs are employed in the telephone plant, and numerous factors must be considered when selecting materials for them. The materials generally used have abundant sources of supply, and the quality is carefully controlled by tests that are designed to be easy to apply and effective in evaluating the properties desired. —J. R. Townsend in Bell Telephone Laboratories.

SIMPLE, ISN'T IT?

The changing from aerial to underground of the Cleveland-Toledo A and B cables between poles 4,497 and 4,578 brought to light some interesting facts from our inquiry of General Foreman Pat Wise, who supervised the work done by Cable Foreman R. N. Pettitt. This included a load fixture which was transferred to a manhole, all while the cable circuits were in use and without causing a single case of trouble. The conduit work which had been contracted for was under the inspection of J. O. Scott.

The cables were kept under gas pressure in order to reduce the tendency to kink and to give warning in case of an opening in the sheath. Six poles of the Toledo-Fostoria fifty-wire line were between the aerial cable line and the conduit. To make the transfer these poles were cut off at the ground, raised, and the cable passed through under them. New poles were then set.

In order to lay the cable, two six-inch and one four-inch oil pipe lines were cut, as well as a number of gas, water and sewer lines.

The weight of the five load pots and the cable was estimated to be ten tons. These were lowered by bolting angle irons from the tops of the two poles of the fixture and fastening the cables and pots to prevent possible shifting. Gin poles; massive blocks and tackle; moving with skids and rollers to the manhole built to accommodate it; more gin poles; winches; derricks; angle irons; five-ton chain falls; building movers' blocks; concrete; racks—that's what's involved until eventually a nice underground load point has been made. Very simple, isn't it? When you know how!—Chris Gasser, in Long Lines.

Something to Think About

By Long Distance

Some telephone companies are progressive while others have not yet adopted the handset type telephone.

The telephone number of the Checker Cab Company in Columbus, Ohio, is Adams 5231. They advertise that an easy way to remember their number is to think of 52 weeks in a year and 31 days in a month.

The Holden Hotel in Dayton, Ohio, is the only place I have ever noticed colored girl operators on a PBX switchboard.

Local troublemen while on a job nowadays wear good clothes, drive a nice car and keep their nails clean. This is quite a contrast to the days when we used to walk or ride a bicycle, crawl under houses and into attics and didn't think much about our nails except when we broke them off.

Although the day was hot we spent fifteen minutes examining a trouble car which had a ladder in four sections each about five feet long clamped in place vertically, two on each running board. This seems a sensible idea and much better than the old practice of carrying a longer ladder horizontal thru heavy traffic. With this sectional ladder the troubleman can connect as many sections together as needed on each particular job. Yes we are progressing.

It is noticed that in a number of the larger manual exchanges around the country that the operators are not required to use the old stock phrases in answering calls. Instead of the usual "Thank You" they may say "All right, Sir," "I will, Sir," or any other phrase that fits in easily. This seems to be a much better plan and it is believed that operators will do better work when they are permitted to be natural.

While passing thru a small exchange the other day I noticed eleven splices in one span of aerial cable. I could not help but think of the money this manager could have saved had he bought some new cable several years ago.

ITALY TO HAVE MODERN CABLE SYSTEM

The Italian Government recently published a royal decree awarding a contract which will complete the telephone toll cable system of Italy, thus giving that country the most modern telephone cable system in the world. This contract, costing $11,400,000, awarded the Societa Italiana Reti Telefoniche Interurbane, an affiliated company of the International Standard Electric Corporation, is for a cable from Naples to Palermo, Sicily, and from Naples to Bari on the Adriatic Coast, and includes a submarine cable across the Straits of Messina.

The entire cable and most of the apparatus will be manufactured in Italy and installed by the Societa Italiana Reti Telefoniche Interurbane, following the designs and specifications of the International Standard Electric Corporation. This will complete the national cable network of Italy from Milan to Sicily and will consist of 4,000 kilometers of cable, 272,000 loading coils, 56 repeater stations and over 2,000 repeaters. The completion of this great project will occupy the combined efforts of the various manufacturing companies associated with the International Telephone and Telegraph System in Italy for several years.

Six Wisconsin telephone companies are seeking authority to increase rates from the railroad commission, including the following: Wayside Telephone Company, Wrightstown Exchange, Alto Telephone Company, La Crosse Telephone Company, Spider Lake Telephone Company, and the North Wisconsin Telephone Company.

Cable Climbs Side of Mountain

Robert Davidson's Story Which Appeared in the September Issue of The Transmitter Is Reprinted Here—In This Story He Tells How an Aerial Cable Was Laid Eleven Miles Across Piney Mountain, One Mile and a Half of Which Dipped Sheer from the Peak at a Grade of Eighty Percent

Any open-wire pole line has its burden to bear during the winter months. But up in the Allegheny Mountains, between Cumberland and Frostburg, Maryland, the toll lead that linked these two cities seemed to get more than its share of sleet and snow and ice. Year after year, Old King Winter seemed to take a special delight in pouncing on this line. Two years ago he delivered such a severe blow with one of his choicest sleet storms that Maryland Plant men called a council of war. Of course, an aerial cable was the logical answer; but that wasn't what the council of war was about. They had known the answer for a good long time. The real problem was to get a cable across the mountains. Even that doesn't sound so much like a problem. But have you ever seen Piney Mountain?

As I write these lines I am looking at a chart of the grade over that pesky hill. It looks for all the world like a chart of the stock market crash last fall. Here goes the dotted line on a nice comfortable rise up and up until, suddenly—bingo! Down she goes in an almost perpendicular drop—down and down, far below the previous level.

This was the grade the cable lead would have to take. Naturaally, one asks why the old open-wire lead was not followed. It is a fair question, but the answer is entirely logical. High tension lines ran close by the old lead and these lines offered too great a menace to the safety of both our men and our plant, and, incidentally, the new route would be much more direct.

The council of war decided that a cable must go up. That was all that the Plant men needed. Grade or no grade, Old Piney was going modern, with a nice new cable for a decoration.

After the right-of-way had been cleared and the poles set by contract labor, our forces moved into position. April 1, 1930, was the date of the official start. And what a day! Just to live up to its reputation, April 1 favored with a blizzard; which wasn't so good.

Frank Adams, Division Plant Superintendent, Maryland, placed H. M. Brooks, Construction Foreman Supervisor, in charge of the operation. Line Foreman P. H. Holmes and M. E. Esworthy handled the line gangs, and splicing Foreman C. F. Ohlhart took charge of the seven splicing crews. Mountain construction work was nothing new to these men.

Much of the 11 miles of the lead was constructed in the usual way. There were difficulties to be met, of course, but every construction man expects difficulties. The only big problem was that mile and a half of 80 per cent grade that dipped sheer from Old Piney's peak.

Looking down this grade from the top of the mountain along the cleared right-of-way, one couldn't help thinking what an ideal spot it would be for a skiing contest. Especially after the April Fool's Day blizzard. One could easily visualize flying forms flashing down the steep side of the mountain at lightning speed, but it took a long stretch of the imagination to see a toll cable firmly established there.

Every operation offered a problem. Even the placing of the cable rings on the messenger. This job took three men to a cable car—two men on the ground, holding the car back with ropes, and the third man on the car. It is understood that this man kept on especially friendly terms with his two buddies, for a lot depended on holding the ropes. It is easy to imagine some sort of conversation as this:

Man-on-ground—"Hey, Bill! How about lending me three bucks till Wednesday?"

Man-on-car—"Sure thing, Ike; why not make it five?"

Of course, the big job was to get the cable into place on that long, steep grade. It was impossible to follow the normal procedure in this respect. In the first place, it was out of the question to attempt to place the cable reels at the required distances. You can't throw a quarter against a ceiling and expect it to stay there. The law of gravity doesn't work that way. The same thing applies to cable reels. Even if they could have been eased down the side of the mountain in some mysterious way without causing an avalanche it was obvious that they would not remain in their appointed places.

But there is always more than one way to skin a cat. Which truism also applies to placing cables. All of the cable necessary for the grade was brought up to the top of the mountain by teams. Reel by reel it was snaked through the rings, the first section being snaked clear down to the point where the grade straightened out to the level ground. The next section was brought down through the rings in the same manner, until it reached the end of the first section. And so, in this manner, this part of the job was completed without any serious difficulty except a lot of good stout pulling and an excessive amount of mountain climbing. All that the gangs needed to make their equipment complete for this part of the work was a good yodeler.

After the cable was placed the next job was splicing. Here, again, normal routine wouldn't work. It took more than half a day just to get the necessary tools down from the top of the mountain. This was done by lashing a load of tools to a ladder to which was attached a long rope. All that was needed was to start the ladder over the side of the mountain and guide its progress down the right-of-way. This operation was repeated until the tools and equipment were all in place. But it wasn't so simple when it came to lugging tools back up the mountain again. Most of the tools went back up the grade on the backs of the men.

At the start of the job a 2,000-foot rope was placed along the grade and fastened at the top of the mountain This worked fine as a hand-over-hand elevator and was of great assistance to the men in climbing the grade. But somebody stole the rope after a few days, and from then on getting up the hill was a matter of catch-as-catch-can.

During the splicing work, the men had to be prepared for rain at a moment's notice. Foreman Ohlhart says that clouds would form and seem to break against the side of the mountain with surprising swiftness, and their breaking invariably resulted in a sudden downpour. This meant that wet weather precautions were constantly in use.

But with all the hard work the job had a lot of pleasant features. The crews were quartered in the beautifully situated town of Frostburg, and every man on the job carries pleasant memories of the fine treatment accorded the men by the people of that delightful town. Even up in the mountains, where the mountaineers look pretty much askance at outsiders, the boys made many friends. Foreman Ohlhart, in his jovial way, made comrades of the mountain children. He brought them candy and peanuts and toys—luxuries that some of the youngsters had never before seen. And, after our men had firmly established them-

(*Continued on page* 38.)

THE

UNITED STATES INDEPENDENT TELEPHONE ASSOCIATION

Will Hold Its

Thirty-Fourth Annual Convention

Of The

Independent Telephone Group

October 14th to 17th, Inclusive

At The

HOTEL STEVENS, CHICAGO

Exhibits of Equipment
Program of Interest
Pioneer's Entertainment

All Officers and
Employes of Independent
Companies Invited

News From the Field

Bids have been submitted to the Rio Grande Valley Telephone Company, Brownsville, Texas, on the new telephone building which the organization expects to construct.

Voters of Danville, Va., will decide which of two companies shall purchase the local utilities at a referendum to be held in October. Although the city council accepted the bid by the Western Power Light and Telephone Company, of $4,300,000, over that of the Tri-Utilities Corporation, which bid $4,350,000, the council felt that the primary power advocated by Western would benefit the city more than a combination of primary and secondary desired by Tri-Utilities. The final decision will be made by the voters.

Although the Postal Workers' Union in Great Britain objects to the employment of women as telephone operators, the service would be improved if the operators were women, according to the Postmaster General. He says women take only six seconds for a connection, whereas men require thirteen seconds.

Construction of a six-story building on the old capitol square in Charleston, W. Va., will be started soon by the Chesapeake and Potomac Telephone Company of West Virginia. The building will be a 15-story structure and the project will mean an expenditure of about $2,243,000.

A co-operative telephone company to be known as the Sorum Telephone Company was formed recently at a meeting of residents of Sorum, S. D. The company plans to build a line from Sorum to Strool, where it will connect with a Bell company telephone line to Lemmon.

Investigation of rates of the Tri-State Telephone and Telegraph Company of Minneapolis, Minn., has been postponed to allow the Minnesota Railroad and Warehouse Commission to ask the 1931 Legislature for a revaluation of the Tri-State properties in Minnesota.

James T. Moran, for thirteen years president of the Southern New England Telephone Company, New Haven, Conn., has resigned from that post. The board of directors elected him chairman of the board. Harry C. Knight, vice-president and general manager, succeeds Moran as president.

The American Telephone & Telegraph Co. and International Telephone & Telegraph Co. will construct a talking cable from Key West, Fla., to Havana as a supplement to the old Key West-Havana cable owned by the Cuba Telephone Co., in which the two companies have an equal interest.

A new telephone building is in the process of construction in Kinsley, Kans.

The Southern Indiana Telephone and Telegraph Company will move into its new building in Seymour, Ind., in October, according to L. C. Griffitts, president. The executive and administrative quarters on the second floor will be occupied about a week prior to the first floor, which will be occupied by the clerical force, he said.

The Associated Telephone Utilities Company has acquired the Manson, Chelan Valley, and Entiat Telephone Companies, all in Washington, and the Holton Telephone Company in Wisconsin. This addition increases the total number of communities served by the system to 1,590.

The Standard Telephone Company's system with headquarters at Follett, Okla., will be remodeled this winter at a cost of $10,000. In addition $7,500 will be spent on a new toll line from Shattuck, Okla., to Perryton, Okla.

The Western Electric Co. has purchased sufficient copper to care for needs of the Bell System for 1930, according to Edgar S. Bloom, president. The purchase is said to aproximate 100,000,000 pounds.

Bowen, Gould & Co., Inc., New York bankers for the Basic Utilities Corporation, has acquired the Lexington Telephone Company for about $300,000. The telephone company supplies Lexington and Buena Vista, Va.

Work has been started on the new telephone building which is to be erected in Hitchcock, Iowa, by the Western Farmers Telephone Company.

MIDWEST STATES BUYS PHONE UNITS

Five telephone properties in northern Illinois, Iowa, Minnesota and Wisconsin have been added to the Midwest States Utilities Company system through completion of purchase contract for acquisition of all outstanding common stock, according to Lon J. Jester, vice-president.

The companies have been operating for several months under temporary management agreement with Midwest States.

The newly acquired properties operate seventeen exchanges, serving seven towns in Illinois, eighteen in Iowa, twelve in Minnesota and eleven in Wisconsin. Toll pole lines total 125 miles and all lines establish toll connections with the Illinois, Wisconsin and Northwestern Bell Telephone systems.

CABLE CLIMBS SIDE OF MOUNTAIN

(*Continued from page 36.*)

selves as friends, older members of the mountain clans would often come out to watch the progress of the work. Occasionally, there would be a gun strapped to a hip in business-like fashion. And on one occasions, when a lanky mountaineer was asked if he could shoot straight, he replied: "See that thar pine burr atop that thar tree?" (The tree in question was 50 yards away.) Then there was a slow, graceful movement of his hand and arm. A sudden report—and there was no longer a pine burr "atop that thar tree"!

A cable that varies in size from 92 pair to 193 pair duplex now connects Frostburg and Cumberland. The job was finished just three months after it was begun. Twenty-four men were engaged in the work. No one lays any claim that it represents more difficulties overcome than have been overcome before. Certainly there have been many construction jobs on a vastly larger scale, which were carried on under more severe conditions. But it does represent a test of the ingenuity and stick-to-itiveness of the telephone construction man. And, next winter, when the snow and the ice and the sleet rage around Piney Mountain, Maryland Plant men can just sit back and smile.

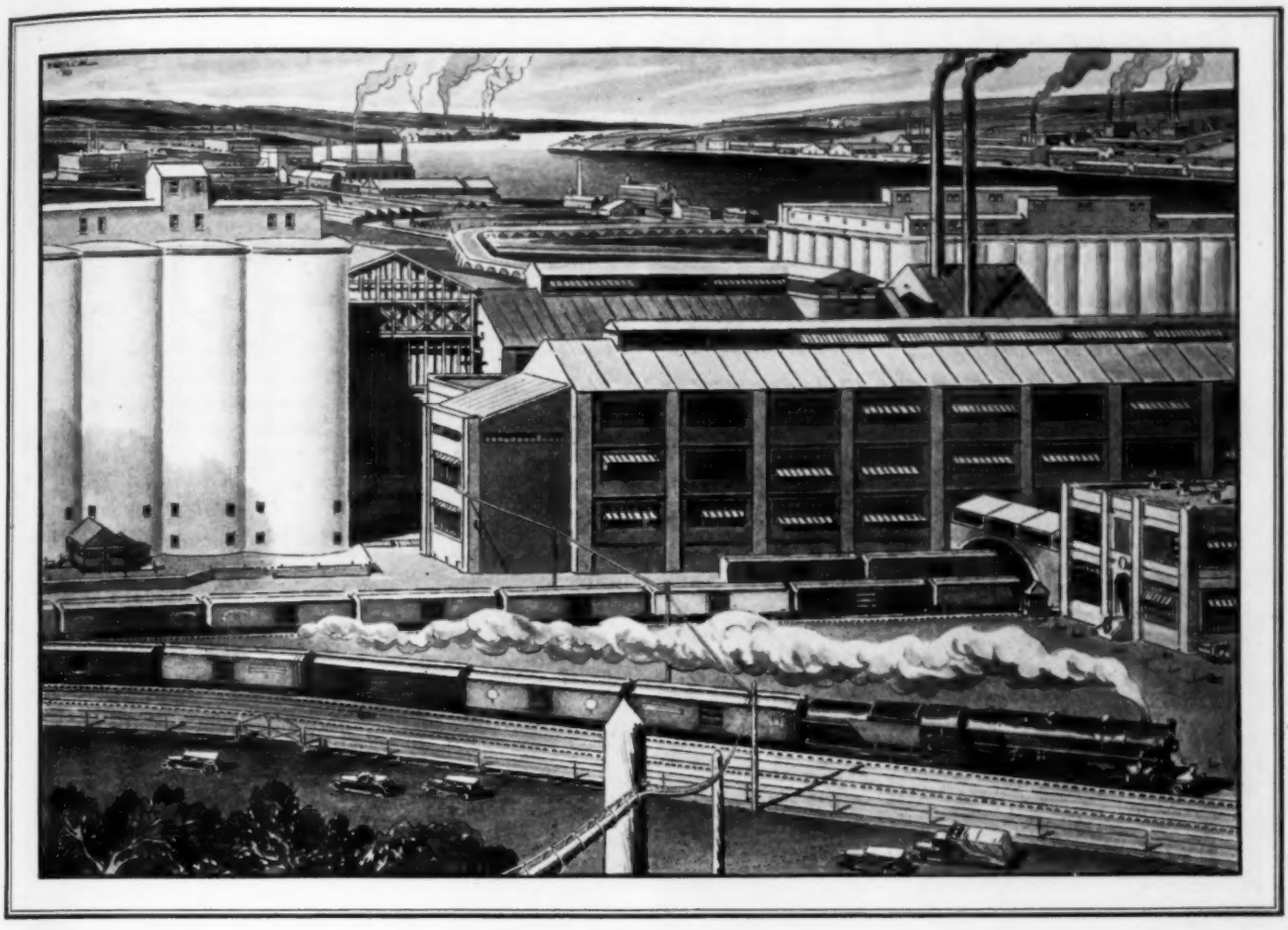
NATIONAL TELEPHONE CONVENTION NEXT WEEK

(*Continued from page 33*)

well for persons contemplating attending the convention to notify their local agent in ample time so that he may provide himself with the necessary form.

"Immediately upon arrival at the convention the certificate should be deposited with the secretary at the registration desk for validation.

"Tickets will be on sale at stations in Oregon (via California), October 6th to 12th; in California, October 7th to 13th; in Arizona, British Columbia, Idaho, Montana, Nevada, Oregon (not via California), Utah and Washington, October 8th to 14th; in Colorado (except Julesburg), Oklahoma, Texas, New Mexico and Wyoming, October 9th to 15th; and in the remainder of the country, October 10th to 16th. Final honoring return date on all tickets purchased with certificates, October 21st."



Giants out of the earth

An Advertisement of the American Telephone and Telegraph Company

No AGE but ours has seen so swift and complete an application of natural forces to the doing of daily tasks. Man's leaping knowledge . . . embodied in industrial plants and laboratories, airplanes and electric locomotives . . . has won new power and freedom. Machines are the symbols of a new relationship with nature. They are the servants of this civilization . . . helping men to extend the limits of their opportunities, to change the character of their life.

Americans have been pre-eminent in this change, for in whatever they do they seek to utilize nature to the utmost. They have taken the power out of the earth and from the running streams. They have made it turn the wheels of their industry and move their products by rail and road. They have made color and variety out of chemistry. They have spun metal in slim wires to carry their voices anywhere with the speed of light . . . and make neighbors of the scattered millions of America.

Joining homes and work places, towns and distant cities, the Bell Telephone System has furnished a new communication for this new age. Forwarding the growth of the nation, giving better and more complete service in advance of the demand, its function has become the indispensable one of furnishing the means of social and business contacts in crowded cities and scattered villages over the length and breadth of a continent.

The Bell System is constantly improving the scope, speed and accuracy of its service. Its work of contributing to the welfare and prosperity of American life goes on with increasing purpose and pace.

Identify your inquiry to advertisers by saying—"As shown in TELEPHONE ENGINEER"

Interstate Unifies Columbia City's Telephone System

Two Companies, Competitors for 25 Years, Now Combine as One Unit. New Kellogg Full-Feature Switchboard Recently Installed. By H. W. Hogue, District Manager, Kellogg Switchboard & Supply Co.

It would be hard to find a town more satisfactorily adjusted and balanced with regard to factors that make for growth and progress, than Columbia City, Ind. Commerce, agriculture, industry, civic pride, civic beauty—it has all of them and more. The town lies in Indiana's richest farming district, yet it does not depend entirely upon its agricultural resources for its revenues and prestige. Commercially, the town lies on the main line of the Pennsylvania Railroad and upon two national highways leading to the country's market centers. Both avenues of transportation are extensively used to move manufactured goods, poultry, dairy products, and agricultural products including 1,000 carloads of onions annually.

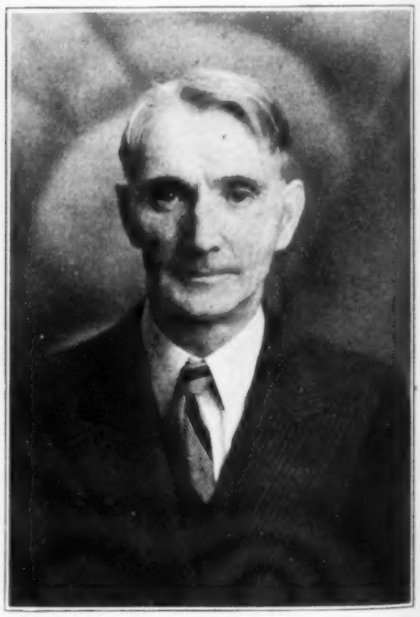
Sam Tomlinson, Vice-President of the Interstate Telephone & Telegraph Co., Indianapolis, Ind., is in Direct Charge of the Long Distance Lines of the company.

Industrially, Columbia City is famous for the Columbia Woolen Mills, manufacturing the material used throughout the country in letter-carrier and other uniforms. The S. J. Peabody Lumber Company maintains the largest hardwood lumber mill in the middle-west here. In addition, there is a large packing plant, a garment factory, a good-sized foundry, and several other industrial plants that help to maintain a steady, even rate of production and employment throughout the year. It is interesting to note that all the larger plants mentioned have been running continuously without a shut-down since the war. The Columbia Mills is the only woolen mill in the country that has been able to maintain such a record of production. Columbia City has some 3,800 inhabitants and is widely known for the beauty of its streets and buildings, both residential and commercial. Yet, despite her fine commercial record and progressive people, Columbia City, until a short time ago lacked one prime essential for a model town, and that was—a centralized telephone system.

P. J. Maloney, manager Whitley County Telephone Company, General Manager of Mid-West Supply Company and in charge of all construction work of the Interstate Telephone & Telegraph Company.

For twenty-five years Columbia City had been holding its more or less private telephone conversations over two separate systems. While the service of each individual company was beyond complaint, the combined workings of both was anything but convenient to the company subscribers and their thrifty neighbors who preferred to do their conversing over borrowed phones. As former vice-president, Thomas R. Marshall, who is from Columbia City once said "What this country needs most is a good five cent cigar," so it can be quoted "What this town needs most is a good one-company telephone system."

Competition between the Farmer's Telephone Company and the Whitley County Telephone Company was so strong that the people of Columbia City saw little likelihood of the two companies ever merging. Naturally, considerable waste and duplication of effort were to be found and the telephone service rendered by two companies was not as effective as a single system would have been. Finally, however, the Interstate Telephone and Telegraph Company, appreciating the need of a unified system in Columbia City, bought both of the independents. Plans were made for an elaborate system. The Interstate Company foresaw possibilities of considerable expansion for a town as favorably



J. W. Scott, General Commercial Manager, built up the Commercial Telephone Company into the finest exchange in Indiana through his intelligent management.

It is our pleasure to exhibit for the first time

The New Leich No. 227 Harmonic Charging and Ringing Converter

at the

United States Independent Telephone Association Convention

Hotel Stevens, Chicago *October 14, 15, 16, 17*

Visit our booth and see this new and improved converter in operation.

As usual, a full line of Leich equipment will be on display.

Switchboards
Telephones
Converters
Accessories

We extend a cordial invitation to make our booth your headquarters while attending the Convention.

LEICH ELECTRIC CO.

Genoa, Ill.

situated and possessing as many oportunities as Columbia City did, so adequate allowances for increased service in the future were planned.

Their deductions have already been proven correct by the 1930 census returns which showed an increase of 10 per cent during the past ten years, a growth that is equalled by only one or two rural cities throughout Indiana.

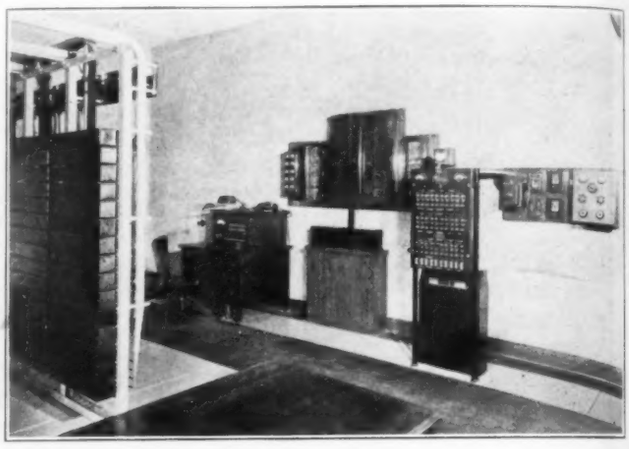
At the time of the purchase of the Whitley County Telephone Company and the Farmers Telephone Company of Columbia City by the Interstate Telephone and Telegraph Company, Mr. P. J. Maloney was General Manager of the Whitley County Telephone Company and was retained in that capacity until now when his duties have been greatly extended. The Interstate Telephone and Telegraph Company chose Mr. P. J. Maloney of Columbia City, Mr. Sam Tomlinson of Plymouth, and Mr. J. W. Scott of Warsaw as three of the outstanding telephone men of Indiana to work out plans for the rebuilding of the telephone system at Columbia City. Undertaking this great responsibility, these three capable men worked hard and harmoniously as a committee to accomplish their purpose. A record of outstanding achievement is shown for their untiring efforts and good judgment in the new and well-planned system.

Mr. P. J. Maloney (known to all his telephone friends as "Pat") is a graduate of the Indiana University, and was a school teacher before entering the telephone business some fifteen years ago. Mr. Maloney has been a careful student of public utility problems for many years, and is a diligent and tireless worker. He is past president of the Columbia City Rotary Club, and has been identified with much public spirit work in his community. It is due to his personality and efforts that the telephone company's relations with the people of his community are so pleasing and agreeable. He is president of the Northeast Indiana Telephone Association, and a director of the Indiana Telephone Association. Mr. Maloney is now General Manager of the Mid-West Supply Company and also in charge of all construction work of the Interstate Telephone and Telegraph properties. He is a firm believer in good service, good maintenance, and good construction.

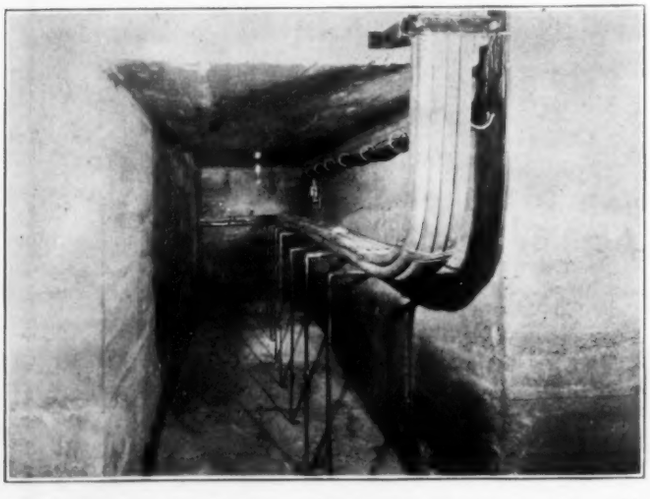
Mr. Sam Tomlinson was born a Buckeye, but a Hoosier by adoption. His telephone activities began way back in the days of the old Winchester Telephone Company of Winchester, Ind. Later with the Messrs. A. B. Digg and W. S. Daniels he organized the Winona Telephone Company, and was president of this company from its inception. Three years ago, when the Interstate Telephone and Telegraph Company took over the Winona properties, Mr. Tomlinson joined that company as vice-president, and is now in full charge of all toll line activities. He has been president of the Indiana Telephone Association, and is now a director of that association .

Mr. J. W. Scott has had a long and successful career in his chosen business of operating telephone properties. He started his activity many years ago at Lebanon, Ind., and later went to the Commercial Telephone Company of Warsaw, Ind., where, through his intelligent

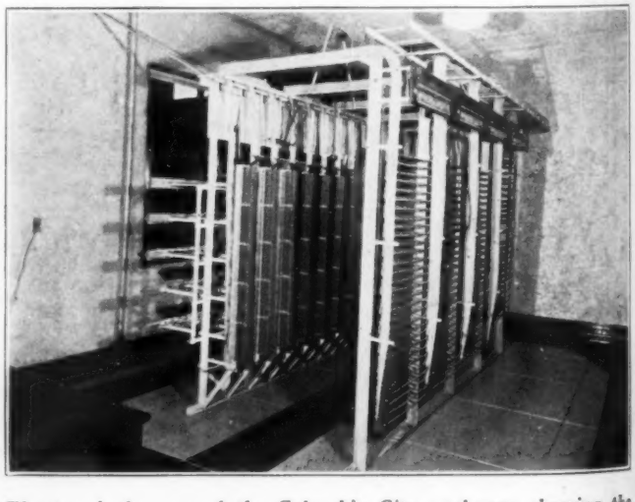
The beautifully furnished rest room for the convenience and comfor of the Columbia City operators.



This view shows part of the Terminal Room showing the wire chief's desk and power equipment at Columbia City, Indiana



The underground cable vault showing where the outside cable enters the new Columbia City exchange building.



The terminal room of the Columbia City exchange showing the main frame, relay equipment and the Kellogg method of cabling.

WELCOME MR. TELEPHONE MAN!

You Will Find on Display in Booths 10 and 11 The Latest Developments in Telephone Protection

Make Your Headquarters at the Reliable Headquarters Throughout the National Convention

Reliable Electric Company

3145 Carroll Avenue Chicago, Illinois

management, this company has developed into its present position as one of the best telephone properties in Indiana.

Mr. Fred Howell, plant superintendent of the Whitley County Telephone Corporation, ably assisted in charge of supervising the construction and consolidation work of the properties. Mr. Howell has been with the old Whitley County Telephone Company since 1905.

Because of the need for a more efficient type of equipment at Columbia City, it was necessary to consider the purchase of entirely new equipment. Messrs. Maloney, Tomlinson and Scott visited a great many telephone companies throughout the country looking at different types of equipment and installations. Having gathered their data and presented in detail the advantages of each type of modern equipment to the officials of the Interstate Telephone and Telegraph Company, it was decided unanimously that Kellogg central office equipment was the type designed to give the best and most profitable service over a long period of years. Work began with the hanging of 45,000 feet of aerial cable and 51,000 feet of underground cable. Eighty miles of rural lines have been rebuilt and the work is still going on. To house their central office equipment, the Interstate Telephone and Telegraph Company erected a building that is truly an outsanding architectural accomplishment. It is a two-story structure of a new, rough-texture tan brick with Indiana Limestone trim. The window sashes are an unusual piece of ornamental steel work with copper screening. The building fronts on a residential street and is set well back to allow for a lawn that is landscaped in a manner envied by every home-owner in Columbia City. The interior is elaborate with its green stained-oak woodwork and light walls artistically finished in panels and mural decorations. A well-furnished Public Lobby and Commercial Office add much to the building. Venetian blinds lend a final note of beauty and cool comfort. A sizeable storeroom and garage to facilitate maintenance and repair service are situated in the rear. Needless to say, the company's new home has received considerable comment and has been welcomed as an extremely desirable addition to Columbia City's public buildings.

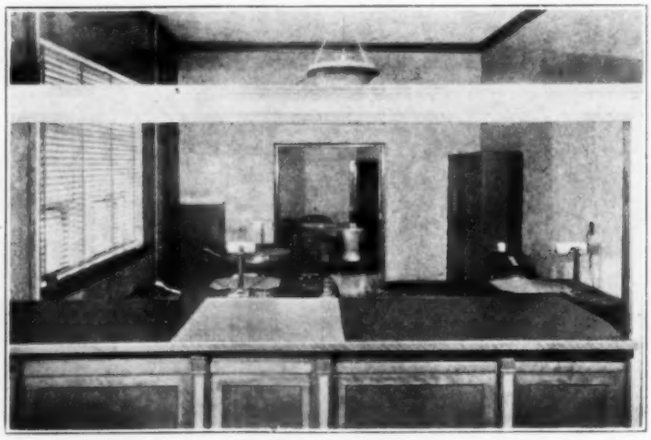
The central office equipment is composed of a six-position Kellogg full-feature switchboard, with a capacity of 1,600 common battery lines; with 900 common battery lines equipped on a four-panel basis with associated line lamps; 120 common battery rural lines with associated line lamps and reversing jacks arranged for ten-party harmonic ringing; twenty free service toll lines multiplied throughout, with the lamp signals appearing in front of first two operators, ten common battery pay station lines and twenty lamp signal toll lines appear in front of the two toll operators. Positions No. 1 and No. 2 are each equipped with eight combination toll cord circuits for toll connections and one Universal cord circuit for pay station calls. Plate glass bulletin holders are mounted flash in each keyshelf. Position three, four, five and six are equipped with eighteen feature cord circuits, each with five-party automatic harmonic ringing, dark keyshelf, keyless listening, automatic peg count, audible busy test, instantaneous disconnect, and line lamp recall. Line and cord test circuits are available to each operator.

They also have installed a one position Kellogg chief operator's and information desk with sufficient in and out lines to take care of this work. In the terminal room is located the main frame, relay rack, power equipment, battery-cabinet and wire chief's desk.

The main frame is equipped with 1,060 pairs of Cook No. 100 protectors and 1,800 cable terminal. The power equipment consists of one set of forty volt, twenty ampere battery, one power board with automatic charging control, and automatic interrupter control. One General Electric Company twelve-ampere self-starting rectifier, two sets of interrupters, two sets of Kellogg No. 19 pole changers. For the convenience of the wire chief they have installed a Kellogg combination wire chief's desk and toll test panel. This equipment is worthy of

The new $60,000 office and exchange building of the Whitley County Telephone Company at Columbia City, Indiana, which houses the new Kellogg central office equipment recently installed.

Commercial office of the new Whitley County Telephone Company's exchange at Columbia City, Indiana, showing in the background the entrance to the private office of Mr. P. J. Maloney General Manager.



The well-planned operating room of the Columbia City exchange showing the new 6-position Kellogg full-feature switchboard and new chief operator's desk.

Expanding Anchor

EVOLUTION

1929

1928

1927

1926

BETTER ANCHORS —
BETTER LINES —

COPPER · ALLOY STEEL, *known for its High Resistance To Rust,* is now used exclusively in the manufacture of **Chance** *Improved Expanding Anchors.*

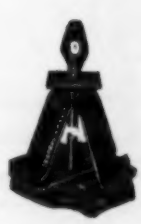
NO ADVANCE IN PRICE!

The increased life of COPPER · ALLOY STEEL *represents a BIG SAVING in the cost of your Expanding Anchors.*

Always Two Steps Ahead

1929

1928


1927

1926

special note since all toll test jacks and coils are mounted in the wire chief's testing turret. This arrangement will be appreciated by those readers who have had the experience of jumping from test to toll test during times of storm.

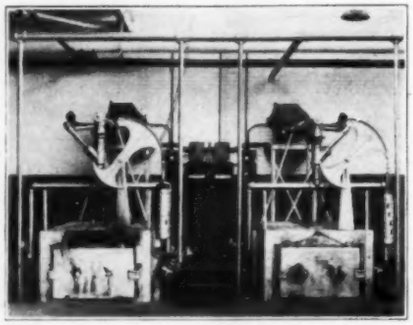
The thorough manner in which the outside plant was built and the substantial, modern new building and equipment, is impressive to say the least. That the owners fully appreciate the necessity of laying a sound foundation and protecting their investment in future years by providing the finest service possible is clearly evident. They have found through past experience that the best is invariably the least expensive in the long run.

The new board was cut-over at 10 p. m., May 13th. Local conversations went on uninterrupted. One long distance call was begun on the old board and finished on the new one without the speaker even knowing that the cut-over had been made.

The people of Columbia City fully appreciate the better service and the various improvements that the new company made. Many comments have been received and it is planned to hold open house so that the public might see the inner workings of a telephone system and better acquaint them with the magnitude of such an undertaking. The Interstate Telephone and Telegraph Company places considerable faith in the idea of making a customer a friend and having him become thoroughly familiar with their work. An interested customer is more usually than not, a satisfied customer. High-grade service backed with a competent management is the basis upon which the Interstate Telephone and Telegraph Company has built its business and expects to protect its investment. At any rate, it has given to Columbia City a long needed improvement and has added the impetus and at least one important requirement for a "Bigger and Better" program of expansion and improvement for the town as a whole.

RELAY CORES SUBJECTED TO INTENSE HEAT TO REDUCE RESIDUAL MAGNETISM.

One of the most important essentials for efficient operation of a telephone switchboard relay is to reduce, as much as possible, residual magnetism in the silicon steel cores of the relays.



Surface combustion furnaces installed in the Stromberg-Carlson plant and in which silicon steel cores for switchboard relays are annealed to reduce residual magnetism to a minimum. An annealing pot in which these cores are packed in cast iron chips to assure against oxidation. The pots are sealed in fireclay.

Among the latest devices employed to manufacture telephone apparatus is the surface combination furnace such as has been installed in the Stromberg-Carlson Telephone Mfg. Company's Plant, in which these steel cores are annealed to reduce residual magnetism to a minimum.

These furnaces have hearths that measure 30x60 inches, a door measuring 18 inches high and 28 inches wide, and are lined with 4½ inch fire brick and tile with 2½ inches of heat resisting insulation. Each furnace is fired with the modern surface combustion equipment, four burners on each side, one set firing tangentially against the roof and the roof and the other under the hearth, and from the opposite side. This assures complete circulation of the products of combustion and uniform heating.

Relay cores are packed in steel boxes and the boxes are put in air tight annealing pots which are sealed in fire clay. Inside the pots and around the steel boxes is placed a quantity of cast iron chips to further assure against oxidation.

The pots are then placed in the furnaces and heated to 1525 degrees F. for a period of six hours. The method used is to bring the furnace and pots up to temperature in the evening, shut off the burners and leave the furnace closed over night. It can readily be seen that the steel cores are free from magnetism after being subjected to such heat.

Another member of the switchboard which must be made exactly to specifications is the spring in the jack. Stromberg-Carlson also has installed the latest machinery designed to turn out these delicate springs.

Two steel rolls, one opposing the other and one with toothed discs to hold the blanks from slipping, form the principal part of these machines. The springs when blanked are automatically stacked in a chute and this chute is placed on the spring machine in such a position as to feed the blanks directly into the rolls.

"BLACK BEAUTY" POLES

Cost less per mile, per year, than untreated poles of any species.

American Electric Company, Inc.

Distributors of "Black Beauty" Poles and Cross Arms to the Independent Telephone Trade

State and 64th Streets : : Chicago, Ill.

Branch Office and Warehouse: 622 Wyandotte St., Kansas City, Mo.

3IO "The International Dating Nail"

International Poles in service 30 years and still strong prove the economy of International Methods

This dating nail in poles is your protection against inferior timber and treatments.

International Creosoting & Construction Co.

General Offices—Galveston, Texas

Plants; Texarkana—Beaumont—Galveston

"STEWART" DETECTO-METER

The "STEWART" Detecto-Meter is guaranteed to locate those bad joints that are sure to give trouble in hot weather. One Illinois company cut out two, one bushel crates of bad wire joints all showing resistance. They brought their lines up in transmission, beyond belief.

The Detecto-Meter will also measure resistance of any part of switchboard or telephone. It has more than 100 uses around the telephone plant. It is also a 150-volt voltmeter. Sent on trial. Price $39.00.

Also lineman's Test Sets with detector coil, Cable Testers and Test Cabinets.

STEWART BROTHERS, Ottawa, Illinois

Safety → $20.00 ← Comfort

TESTIMONIAL—

$20.00

Dowagiac, Mich., April 4, 1930.

Received the Bashlin Semi-Floating Belt, and Safety Strap. The lineman says he would not take $20.00 for the equipment, and do without. Please ship the following:

E. E. Lewis, W. C.

With Tri-County Telephone Co.

Mr. Lineman: Do you know Safety and Comfort? Send for Catalog—Linemen's Equipment.

W. M. Bashlin, Inc., Sta. B., Grove City, Pa.

Identify your inquiry to advertisers by saying—"As shown in TELEPHONE ENGINEER"

RUNZEL-LENZ ELEC. MFG. CO.

ESTABLISHED 1904 **CHICAGO**

Specializing in Manufacture of

CORDS

FOR ALL CLASSES OF TELEPHONE WORK

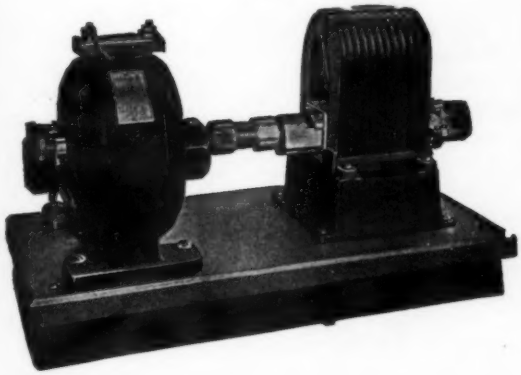
SIERRE EQUIPMENT CORPORATION

Los Angeles—San Francisco—Seattle—Pacific Coast Distributors

HOLTZER-CABOT

Magneto - Ringing - Motor - Generators

Maintain Better Service



Maintaining an efficient, economical, carefree ringing service need not be a problem—but it does require good judgment in selecting your equipment.

Install Holtzer-Cabot Magneto Ringing Motor Generators. These units will enable you to dispense with battery maintenance and constant service diligence. Can be supplied for any voltage or special current.

We invite correspondence. Complete data on request.

HOLTZER-CABOT ELECTRIC CO.

125 Amory Street, Boston, Mass.

6161 So. State Street, Chicago, Ill.

TELERING

For Central Office and PBX Ringing

IN USE ALL OVER THE WORLD

DON'T FAIL TO SEE TELERING AT THE CHICAGO CONVENTION

More power than you need

IT PAYS FOR ITSELF

Converts Commercial Alternating Current to Telephone Ringing Current

POSITIVELY NO RADIO INTERFERENCE

Very low current consumption

Price $44.00—F. O. B. Elyria

Fully Guaranteed

Sold by Leading Telephone Distributors

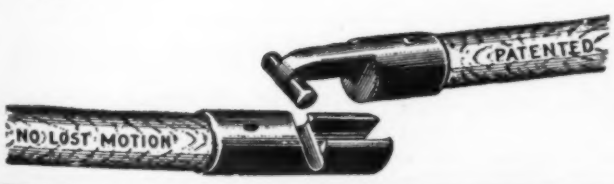
Telkor, Inc., Elyria, Ohio

(Write for booklet)

"Cope"

Patent Quick Coupling Conduit Rods

They will not come uncoupled in the duct



T. J. COPE, Inc.

Manufacturers of

Complete Equipment for Cable Installation

6122 Vine Street, Philadelphia, Pa.

19 So. La Salle Street, Chicago, Ill.

ASSOCIATED TELEPHONE SYSTEM EXPANDS

The total number of stations served by the Associated Telephone Utilities System increased 72,010 during the first six months of 1930 to a total of 449,800, according to figures made public today. This total makes the system one of the largest independent telephone systems in the country.

The system experienced its greatest growth, exclusive of acquisitions, in the territory surrounding Los Angeles, served by Associated Telephone Company, Ltd. This company during the period extended service to 1,449 residential and 834 commercial stations.

Substantial gains were also reported by companies serving in the industrial and petroleum centers of Pennsylvania, in the Panhandle section of Texas and in Wisconsin and Illinois.

According to the figures, the number of cancellations of commercial service decreased and orders for new commercial installations increased during the latter months of the period. Officials of the system believe the figures clearly indicate an increasing commercial stability in the 1,587 communities served.

MANY IMPROVEMENTS IN MIAMI 'PHONE EXCHANGE

Miami, Okla.—The Southwestern Bell Telephone Company has practically completed improvements here costing approximately $52,000. These include placing of underground cable in conduit in the business section, installation of cable on poles in the outlying sections, setting more than 100 poles and stringing approximately 12 miles of copper wire. Work on rebuilding the system here started early in 1929 and there has been on an average of from 10 to 18 men at work on the project since that time.

FOURTH RADIO STATION FOR COMMUNICATION AT SEA

The Mackay Radio & Telegraph Co., Inc., recently started operation of a new trans-Atlantic radio station at Rockland, Me., for communication with ships at sea. This station will operate on both long and intermediate waves and will be known as station WAG. This is the fourth station which this company has established on the Atlantic coast, the others being at Sayville, Long Island, New York City, and West Palm Beach, Fla.

The new station is situated so as to serve ships on the north Atlantic ship lanes and those in arctic waters. Radio conditions along the Maine coast are particularly favorable over practically the entire year, and service from stations there is most consistent. Being so far north, the station also will be able to communicate with ships in arctic waters which may be equipped with radio apparatus capable of sending only short distances. In this respect, Mackay Radio has now done for the Atlantic what it did for the Pacific coast some time ago when it established stations along the Pacific at strategic points designed to cover the Pacific ocean.

The station at Rockland will be directly connected with New York through the lines of the Postal Telegraph & Cable Company, and rates to and from ships via Rockland will be the same as now apply through the other Mackay Radio stations on the Atlantic.

NO MORE WRONG NUMBERS; PARIS "FIXES" SERVICE

Paris.—The French telephone service, which has always been so hopelessly neglected and has made itself known the world over for its particular way of getting on the nerves of American tourists desperately attempting to get a number, is being perfected, according to the minister of post, telegraph and telephone.

New circuits are being installed all over France, where many sections of the country are still unable to communicate with one another, whereas it is possible to telephone to New York, Buenos Aires, Tokio, and most of the world's capitals.

The telephone service in Paris is also being improved and the third automatic exchange will be shortly inaugurated. It is expected that the whole Paris telephone system will be automatic by the end of 1937.

TELEPHONE COMPANY BUYS EXCHANGE AT DAWSON

All assets of the Dawson Telephone Company at Dawson, Ga., have been transferred to the Georgia Continental Telephone Company, which will operate the Dawson exchange as well as exchanges in twenty other cities and towns in Georgia. The new company, which is incorporated in Georgia with a capital of $750,000, will have its headquarters in Dawson.

The new company recently purchased exchanges and toll lines belonging to six companies in the state. The Georgia Continental Telephone Company is a sister organization to the South Carolina Continental Telephone Company, which operates sixteen exchanges in that state. Headquarters of the latter company are in Abbeville, S. C.

The Ohio State Utilities commission has approved plans for the Cincinnati Suburban Bell Telephone company to aid drought sufferers in rural sections by allowing them to pay telephone bills in installments.

TELEPHONE SERVICE OVER PACIFIC POSSIBILITY OF NEXT FEW YEARS

As an initial step in its program of extending transoceanic telephone service into the Pacific region, the American Telephone & Telegraph Company has applied for a construction permit to erect a short wave radio telephone station in California. As radio telephone stations are equipped in the far east and demand for service develops, it is proposed to connect Bell System telephones with one after another of the Pacific countries and island groups through a combination of land wires and short wave radio.

By 1932, it is expected that all subscribers of the Mutual Telephone Company of Honolulu, Hawaiian Islands, will be within voice range of United States telephones. Preliminary arrangements have been made in a series of conferences between Vice President T. G. Miller of the A. T. & T. company and President J. A. Balch of the Mutual company. The radio station facilities at the Hawaiian end are to be provided by R. C. A. Communications, Incorporated. In time, it is probable that direct telephone connections will be established with Australia, Japan and others of the more important far eastern nations.

WOMAN TELEPHONE PIONEER RETIRES

After a telephone career of more than forty-three years, Miss Minnie Jones of East Orange, N. J., has retired with the record for continuous telephone service for New Jersey women.

She began as a telephone operator in Orange back in 1887 when there were only about 350 telephones in the entire district, which included all of Orange, East Orange, South Orange, and Maplewood. The fact that there are more than 41,000 telephones in use in the same area gives a striking idea of the tremendous growth which both the state and the telephone industry have experienced during the last half century. Ever alert to rapidly changing conditions, Miss Jones during her many years of service became one of the best informed and best known of telephone people in the Orange office.

Sixteen different managers have been in charge at Orange since Miss Jones began her services there. In less than a year after she became an operator, Miss Jones was made chief operator, and ten years later she entered the commercial department where she has served as clerk, chief clerk and general clerk.

The Lodgepole Telephone Company of Lodgepole, Nebraska, has just purchased a Stromberg-Carlson 105-C Magneto Switchboard.

Telephone Directory Advertising is Good Advertising - - - - -

That is why it deserves the attention of trained salesmen. Telephone executives now realize more than ever before that the selling of telephone directory advertising is a business separate and distinct from the telephone business. That is why an organization, such as ours, is able to secure far better net results for Telephone Companies than they are able to obtain from telephone employes whose training has been along other lines.

For the past twenty years we have been engaged exclusively in selling telephone directory advertising. Starting in 1910 with a single telephone directory of 4000 copies, our business has gone forward steadily until we are now selling the advertising in telephone directories covering over 2000 cities and towns in 20 states, with a combined circulation in excess of 1,400,000 copies per issue, and new territory is being added constantly.

Selling telephone directory advertising requires salesmanship, because there are many other forms of good advertising available to business men, and in this respect it differs from the selling of telephone service, which is now non-competitive in all but a very few cities. We have an organization of salesmen who are experts in every branch of directory work, and who also know how to deal with the public, the subscribers of the Telephone Companies, in a manner which improves and builds up public relations. We consider this a most necessary and vital part of our service to Telephone Companies, and it includes careful attention to complaints of all kinds from subscribers, regardless of whether or not advertising space is contracted for.

We pledge to our present and future customers that we shall continue alert to every opportunity for further improving our service.

If you have never used our organization to sell your directory advertising you should investigate our methods, and ask for our proposition. Before we accept your directory work we will guarantee either to make or save you money. Could any offer be fairer than that?

L. M. BERRY & CO.

MAIN OFFICE: Keith Building, DAYTON, OHIO - - - - Telephone Garfield 1670

BRANCH OFFICES:

PHILADELPHIA 135 S. Second St.
ERIE 212 Hayes Bldg.
FORT WAYNE 212 Guaranty Bldg.
ELIZABETH 1177 E. Grand St.
ATLANTIC CITY 704 Professional Arts Bldg.
CAMDEN 1212 Income Ins. Bldg.
ALBANY 511 Home Sav. Bank Bldg.
TRENTON 615 Broad St. Bank Bldg.
ROCHESTER 59 Stone St.
SYRACUSE 221 State Tower Bldg.
DURHAM, (N. C.) 108 Holloway St.
BRISTOL, TENN.-VA. 1007 7th Ave.

UNDERGROUND TELEPHONE CABLE

is surely worthy of the very best treatment. So, in pulling it through the duct, we suggest the use of

MINERALLAC PULLING COMPOUND

It saves the lead sheath, shortens the pulling time and cuts down expense of installation.

Ask for the folder on Minerallac No. 150

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street
CHICAGO

The Proof of KESTER Lies in Its Use

Have your line men work with KESTER acid-core SOLDER for one month and see for yourself how it drives away trouble. What's more—KESTER will save time on the job because there's no lost motion fussing with separate and often unsatisfactory fluxes. The 5-lb. spool is being used by the big fellows. Take advantage of their experiments and make KESTER SOLDER your standard, too.

KESTER SOLDER COMPANY
INCORPORATED—1890
0000 Wrightwood Ave., Chicago
The Right Solder for Every Job.
The Right Unit for Every User.

CABLE FAULTS AND HOW TO DETECT THEM

(*Continued from page 26*)

nected with it. If the lengths are different the capacities will be different gauges for which reason the standard should be of the same gauge as the other wires.

Determining the Cause of Unbalances

The wires on which unbalances were found may be tested further to determine the type of fault existing. This may be done by connecting exploring wire "a" to both sides of a good pair. The single wires that balance against this pair are either short circuited or crossed. If both wires of the same pair balance, the trouble is a short circuit. If only one wire balances the trouble is a cross.

Split pairs may or may not be indicated in the ordinary tone comparison tests. A positive check can only be obtained by the continuity test method already described. If the split is between pairs in widely separated groups, a tone may be heard when making the regular tone comparison tests.

Location of Cable Faults

After it has been determined that certain pairs contain a given type of fault, it is, of course, desirable to be able to locate the position of the fault fairly accurately when it is desired to clear it.

Methods of Locating Shorts, Crosses, Grounds and Split Pairs Using an Exploring Coil

Perhaps the easiest method for determining the location of shorts, crosses, grounds and split pairs is by circulating a tone through the fault and passing an exploring coil along the cable sheath.

Figs. 13A, B and C show the methods of connecting the buzzer tone to locate a short, cross or ground, respectively. For all of these connections, when the exploring coil is passed along the cable sheath anywhere between points "A" and "B," a tone should be heard in the head receiver which is connected to the exploring coil. After the exploring coil passes point "B" toward "C" the tone will no longer be heard or will be very much weaker and it will be found that "B" is the point at which the trouble is located. The tone heard by means of the exploring coil will be much weaker in the case of a short due to the greater neutralizing effects of the two conductors of the same pair.

Figs. 14A and B show the method of connecting the buzzer tone for locating two of the common types of split pairs. The elimination of split pairs is, of course, necessary to prevent the cross-talk and noise which generally accompanies this condition on the pairs affected. In Fig. 14A, which is the case of a pair being split at a single point, a tone of a certain strength will be heard when the exploring coil is passed over the cable sheath from point "A" to point "B." After passing point "B" toward point "C" the tone will be somewhat diminished, indicating that the pairs were split at point "B." In Figure 14B the split pair has been again transposed so that the pairs are numbered properly at both

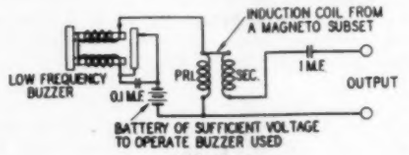


FIG. 12

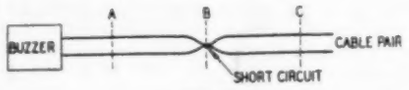


FIG. 13-A

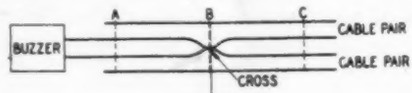


FIG. 13-B

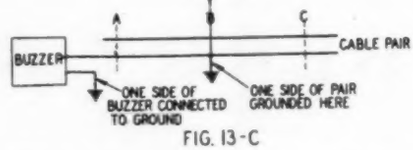


FIG. 13-C

ends of the cable but are split for a certain length somewhere between the ends of the cable. In this case, as the exploring coil is passed from point "A" to "B," a relatively weak tone will be heard, since the two wires are "paired" in this section. From point "B" to "D" the tone will be increased somewhat since the wires are not paired in this section. The

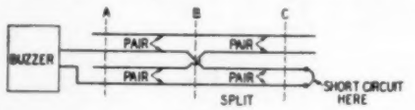


FIG 14-A

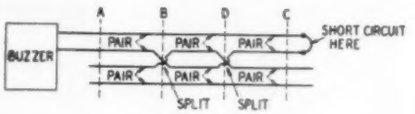


FIG 14-B

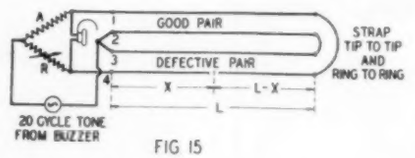


FIG 15

tone will then decrease when the exploring is passed from point "D" toward point "C" since the wires are again paired in this section. Therefore, it is indicated that points "B" and "D" are the points at which the pair is split. Since the splitting of pairs generally occurs only at splices it should not be particularly difficult to locate this trouble in the manner just described, since it is usually necessary to pass the exploring coil only over the splices.

Methods of Locating Shorts, Crosses, Grounds and Opens by Using Various Types of Bridges

Shorts and crosses may be located by using a Wheatstone bridge connected to the two wires which are shorted or crossed and measuring the resistance of the faulty conductor to the short or cross by the usual Varley or Murray loop methods. Knowing the resistance of the cable conductors, the distance to the fault can be determined. Grounds also can be located in a similar manner. The methods of applying these tests will not be taken up here since complete directions are usually included with all bridges designed for this purpose.

The location of opens can be made approximately with the aid of a Wheatstone bridge. We shall consider for a few minutes the application of a simple bridge arrangement which can be made up for this purpose. To locate opens in cable pairs with a Wheatstone bridge it is necessary to use the so-called Murray loop arrangement. A simple arrangement of this type of bridge is shown in Fig. 15.

As seen from Fig. 15, the same type of bridge is used as was used in the tone comparison test except that in this case one of the known resistances is varied to indicate the actual degree of unbalance between the cable pairs which are used in the capacity arms, with the connections made as shown in the figure. The bridge is balanced by adjusting the resistance "R" until no sound is heard in the receiver. Then from the theory of this type of bridge it can be shown that:

$$X = \frac{2LA}{A + R}$$

Where X is the distance to the open, in feet.

L is the total length of the cable in feet.

A is the fixed resistance of the bridge.

R is the value of the variable resistance in this branch of the circuit when a balance is obtained.

An approximate idea of the distance from the central office or from a cable terminal to the location of an "open" in a cable conductor can frequently be obtained by comparing the volume of the capacity click between a good pair and the pair which is open, with the aid only of a telephone test set connected between the cable sheath or ground and the conductors tested.

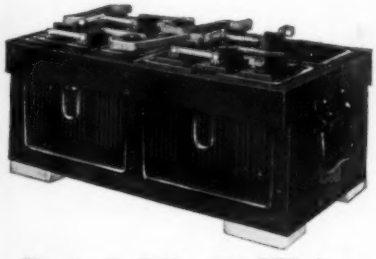
Conclusion

It is hoped that we have been of some help in stimulating interest in this matter, since the prompt clearing of troubles is important from the service standpoint, particularly since many faults, if not promptly cleared may later result in serious sheath failures and general impairment of service. For example, suppose a stray bullet lodges in an aerial cable.

PREPARING FOR TOMORROW

TOMORROW'S TELEPHONE REQUIREMENTS MUST BE FORESEEN TODAY. THIS SYSTEM WILL SPEND $7,000,000 DURING 1930 ON IMPROVEMENT OF FACILITIES AND NEW EQUIPMENT.

Associated Telephone Utilities System



The 11-cell Exide type BTE is a compact and durably constructed Battery. Low gravity electrolyte greatly prolongs its life.

A NEW Addition to the EXIDE Line

At the Chicago Convention you can see the new Exide, type BTE Battery. This battery was particularly designed for such telephone services as magneto, PBX and small common battery switch boards.

At our Booth you will also find other types of Exide Batteries which have been dependably serving the telephone industry for the past 35 years.

No matter what your telephone battery job, there is an Exide that will handle it dependably and economically for a long period of time.

In Booth No. 41

An Exide representative will be glad to show and give you full information and literature about the new BTE type, as well as any other Exide Telephone Battery. If you have any special telephone battery problems our representative will be glad to discuss them with you.

A 2-cell tray of Exide-Ironclad Battery type BI-5.

A typical cell of an Exide Battery of the Chloride type.

Exide

TELEPHONE BATTERIES

THE ELECTRIC STORAGE BATTERY CO., Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

With Manufacturers and Jobbers

SERVICE WITH SAFETY IS CLAIMED FOR WALL FURNACES AND TORCHES

Furnaces and torches for which are claimed an especially high degree of safety are manufactured by the P. Wall Manufacturing Supply Co., Pittsburgh, Pa.

Some of the characteristics of the Wall products, which make them worthy of the company's slogan, "Service with Safety!" include a pump housing of drop-forged steel, which is brazed to the tank; filler plug and supply pipe connections which are machine cut bushings, flanged on the inside and brazed to the tank; a patented burner on furnaces which will operate efficiently in zero weather; seamless drawn brass pump shells with patented check valves; furnace supply valves with brass drop-forgings; and furnace and blow torch tanks which are tested under 100 pounds pressure.

The torches have restful angle handles brazed to the tanks, and pumps are located so that burning of the operator is said to be impossible. Pressed steel drip cups are brazed to supply pipes so they will not leak or work loose.

BELL SYSTEM ACQUIRES TELETYPE CORP.

Negotiations have been completed by the American Telephone and Telegraph Co., to gain control of the Teletype Corp., of Chicago, through an exchange of 150,000 shares of common stock of the two corporations on a share for share basis.

Although the deal represents an exchange of stock with a par value of $15,000,000, based on the closing market price of $210 a share for American Telephone stock on September 19, the date of the announcement was made, the Teletype stockholders are receiving the equivalent of $31,500,000. The acquisition of the Teletype Corporation becomes effective October 1, operating as a division of the Western Electric Co.

For a number of years the Bell System has been the best customer of the Teletype Corporation, although it has sold increasing amounts of apparatus to the Western Union and Postal Telegraph Cable companies. These companies have installed the telegraph printer machines in the offices of the large telegraph users, who are thus enabled to send their own messages directly over the lines of the telegraph ssytems.

The Bell System, in turn, has vied with the telegraph companies of giving telephone typewriter service over its leased wires and has more than 10,000 machines in service for press associations, brokers, business houses, police departments, and so forth.

The apparatus is also used by Bell for its own business, with more than 500,000 miles of circuits affected. The announcement of the purchase stated:

"It seemed desirable to acquire Teletype in order to realize the maximum of progress and economy through the complete coordination of research, development, and manufacture."

Sterling Morton, president of the Teletype Corp., says that sales of the Teletype Corp. totaled about $12,000,000 in 1929 and will be somewhat under that figure this year. The Teletype plant occupies more than a block of city property at Wrightwood and Southport avenues in Chicago and employs about 2,400 workers at capacity operations.

Mr. Morton stated also that the foreign organization and rights of the company have been sold to Creed & Co., Ltd., of England, a subsidiary of the International Telephone & Telegraph Corp. The rights cover all countries of the world with the exception of the United States and Canada.

STROMBERG-CARLSON TO HAVE LARGE DISPLAY AT CONVENTION

Twenty-four delegates will represent the Stromberg-Carlson Telephone Manufacturing Company at the National Telephone convention in Chicago, October 14-17.

Those who will attend are: W. Roy McCanne, president; George A. Scoville, vice president in charge of sales; R. H. Manson, vice president and chief engineer; E. A. Hanover, vice president in charge of manufacturing; B. Woodbury, telephone sales manager, E. A. Reinke, commercial sales manager; E. G. Eidam, assistant chief engineer; W. T. Eastwood, advertising manager; F. C. Young, development engineer; J. A. Levis, telephone engineer; W. Powell, patent engineer; E. E. Tune, telephone engineer; J. C. Snyder, R. H. Barger and C. H. Bergmann, sales engineers.

In addition to Rochester delegates the following will attend from branch offices: Kansas City, A. J. Roberts, J. P. Galligan, P. Winemiller and C. D. Kinne; Chicago, C. W. Shafer, H. T. McCaig, C. F. Sanders and M. W. Redmond; Toronto, N. W. Baldwin.

Stromberg-Carlson will have the same booth as last year and will again have an interesting display. The following will be exhibited:

No. 105 Magneto Switchboard, No. 102 Magneto Switchboard, No. 12 Super Service Switchboard Section, Central Energy Telephones, No. 104-C Cabinet, a two-position Junior Multiple Switchboard, Magneto Telephone Display, Churchill Booth, construction materials, Aircraft Radio Receiver, Nos. 14, 846 and 654 Radio Receivers, portable loud speaker and Program Service Frame.

F. C. Young, development engineer, will speak on "Ultimate System for Program Service and What the Future Holds," during the Program Service meeting, October 17.

L. L. HILL, EXECUTIVE VICE-PRES. NAUGLE POLE & TIE CO.

L. L. Hill, of Minneapolis, one of the best known pole manufacturers in the United States, is now connected with the Naugle Pole & Tie Company of Chicago as executive vice president.

Mr. Hill was formerly connected with the Page & Hill Company of Minneapolis, and has seen over quarter century of service in the cedar pole industry. He is well throughout the telephone industry, as well as in other public utility fields. Friends of Mr. Hill throughout the country will be glad to learn that he is back in his familiar field and will welcome him as in the past.

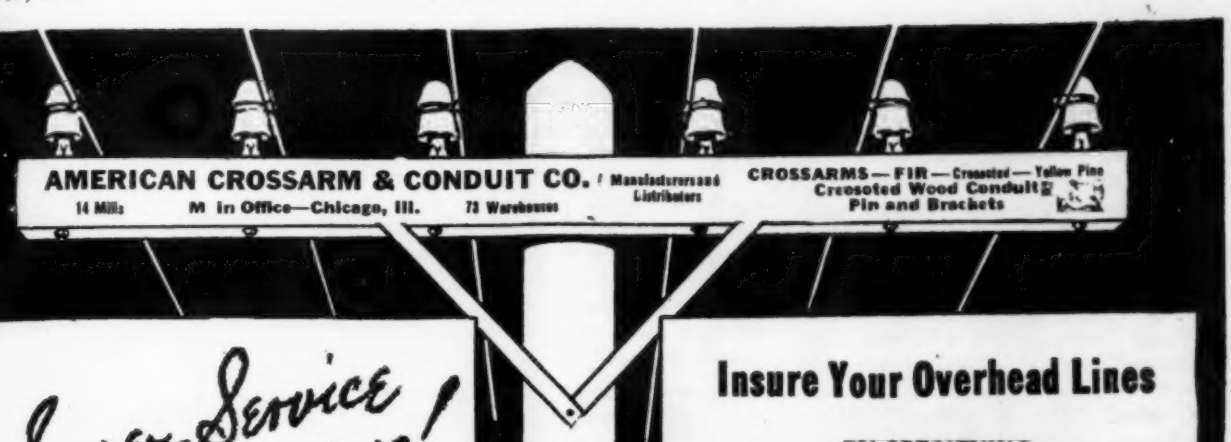
COOK ELECTRIC CO. ISSUES NEW CATALOG

A new catalog showing various types of terminals and protectors made by the Cook Electric Co., has just been issued by that concern. Printed in two colors the catalog contains a number of illustrations and is of a size convenient for use and easy filing.

The publication is a reference book on protective equipment for the telephone plant as well as a catalog. A copy may be obtained by request to the Cook Electric Co., 2700 Southport avenue, Chicago, Ill.

WINTHROP, MAINE, ORDERS STROMBERG BOARD

The Lewiston, Greene & Monmouth Telephone Company of Winthrop, Maine, has just ordered a two-position junior multiple switchboard from the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. The board will consist of 200 lines and will be complete with power, machine and terminal equipment.



Super-Service on rush orders!

If you are in a hurry your order can be loaded and on the way the same day we receive it. Quality poles since 1882 assures you of guaranteed stock and satisfactory dealings. Let us quote you prices.

Northern and Western Cedar
With or without butt treatment

NAUGLE POLE & TIE COMPANY
59 East Madison Street, Chicago
Branches: New York, Columbus, Kansas City, Spokane, Los Angeles, Boston, Madison.
Main Yards and Butt-treatment Plants: Minneapolis, Pinconning, Michigan, Spokane, Sand Point, Idaho, Seattle, Arrowhead, B. C.

Naugle Poles

Insure Your Overhead Lines

BY SPECIFYING

MacGillis

NORTHERN or WESTERN

CEDAR POLES

PLAIN or BUTT-TREATED
FROM

MacGillis & Gibbs Co.
120 E. Wisconsin Avenue
MILWAUKEE - WISCONSIN

DEPENDABLE
Northern White Cedar Poles

that offer *utmost* in Quality and Value. *Guaranteed* Butt Treatments

MICHIGAN POLE & TIE CO.
NORTHERN AND WESTERN POLES
NEWBERRY, MICHIGAN
Reed City, Mich. YARDS St. Paul, Minn.

Takes the place of 6 men . . .

Simplex Pole Jack

Templeton, Kenly & Co., Ltd.
Sole Manufacturers
Established 1899 Chicago, Ill., U. S. A.
Foreign Distributors:
International Standard Electric Corporation
Northern Electric Company, Ltd.

Cedar Poles

Northern White Western Red
Plain or Treated Butts

Prompt Shipment from Minneapolis Yard.

T. M. Partridge Lumber Co.
Minneapolis, Minn.

"BIGGER PROFITS" WITH NEW BUSINESS CAMPAIGN

This morning's mail brought with it something quite unusual and interesting in the way of specially prepared material to help the telephone company build up its business. It was a strikingly illustrated, two-color broadside with an outside caption reading, "Climb on the Band Wagon." A fold or two later, pictures a group of telephone men riding away to "Bigger Profits," while a heading, "Our Slogans," lists under it several lines, such as, "More extension phones," "More P. B. X. sales," "New Subscribers," "Bigger and better lists," "Come, blow your horn," etc.

The inside spread details the entire story of how Kellogg Switchboard and Supply Company is interested in the success of the telephone companies throughout the country. "How to make more money through the use of a new business campaign," is the theme of the folder. Companies are shown how they can make bigger profits, and as proof, several instances of other exchanges who have profited in past years, are cited. Results obtained by two companies who have utilized such a campaign as this to increase their business are included here. Both these companies are made up of a number of exchanges ranging from 140 stations up. In a number of cases the success of the smaller exchanges overshadowed the larger ones—proof that the small exchange as well as the larger ones can use a campaign to good advantage.

Rochester Telephone Company, Rochester, N. Y., signed 3,755 new subscribers, 400 extensions, additional lines and many special services in a two-weeks' drive. All employees were listed as salesmen. Drive extremely successful, netting 231 per cent of quota.

Lincoln Telephone & Telegraph Company, Lincoln, Nebr., in a week's drive, enlisting the aid of all employees, made 2,691 sales, which was 172 per cent of quota. Drive was backed by newspaper advertising and much enthusiasm shown on the part of company workers.

A questionnaire is attached to the New Business Campaign broadside which the telephone companies are asked to fill out and return. From this information the Kellogg Advertising Department designs a New Business Campaign especially planned for each individual company, according to its requirements. There is no charge, of course, for this campaign to the telephone company.

Kellogg has gone a long way toward helping its customers increase their business. Past experiences have shown these campaigns to be highly effective in securing new subscribers, more extension lines and in a general building up of good-will for the exchange. Here is a sure thing for the phone company — everything to gain and nothing to lose. From the reports that we have heard, the results from the mailing have been very good—a fact that gives evidence of the average telephone company's progressiveness and desire to do something in order to secure more business. It seems as though Kellogg's Advertising Manager, Ray. C. Krueger, and his staff are going to be kept busy. At any rate, if the rest of the campaign is as good as the broadside, the telephone companies are going to have an excellent means of building up business at their disposal.

The new campaign, from what we have been told, contains many new features that will bring some extremely good results to those companies using it. It is especially prepared to fit in well with all company policies, it covers the most logical advertising mediums with a variety of materials and complete advertisements. Detailed instructions for conducting the campaign are also included.

If you have already received your broadside, return the questionnaire at once properly filled in—it will pay you well, and yet costs you nothing. If you haven't yours, simply write to Kellogg for a questionnaire on the New Business Campaign.

FRANK L. ELDRIDGE COMPANY NEW DISTRIBUTING ORGANIZATION IN CHICAGO

Under the name of Frank L. Eldridge Company, Frank L. Eldridge, well-known in the telephone sales field, has opened an office at 11 South La Salle street, Chicago, where he will distribute dry batteries and other products to the telephone and railway field through jobbing organizations and telephone equipment manufacturers.

Mr. Eldridge has been engaged in promoting the sale of dry batteries for the past 11 years, and from his new office in Chicago will distribute the well-known products of the French Battery Company, Madison, Wisconsin. In connection with this activity, he will also act as distributor for other well-known products extensively used in the telephone field.

For some 25 years ,Mr. Eldridge has been engaged in the telephone field, the past 15 of which have been devoted to sales work. His many friends throughout the industry will be glad to learn of his new association and wish him well in this activity. His address at 11 South La Salle street, Chicago, friends will recall, is the same as that he formerly had for several years. He invites them to call on him whenever in Chicago.

Members of the Minneapolis city council sewer committee are endeavoring to bring action to eliminate the toll rate between Minneapolis and St. Paul.

FOLDER ILLUSTRATES LINEMAN'S EQUIPMENT

W. M. Bashlin, manufacturer of individual lineman's equipment, has published an interesting folder, illustrating and describing his complete line of this equipment.

Comfort, safety, and quality are the claims Mr. Bashlin makes for his line of goods, which includes floating tool belts, safety straps, hook pads, hook straps, special gloves for special jobs, pliers and plier holsters.

Those who have not received a copy of this folder may obtain one upon request to W. M. Bashlin, Inc., Grove City, Pa.

STROMBERG-CARLSON TO GIVE AWAY RADIO SET

As a feature of the National Telephone Convention the Stromberg-Carlson Telephone Manufacturing Company will give away one of its No. 10 Radio receivers. Last year that company gave away one of its No. 641 Table models.

The rules will be the same as last year. Each visitor to the Stromberg-Carlson booth will be furnished a registration slip.

H. T. McCaig, assistant manager of the Stromberg-Carlson Chicago office, will have charge. Last year a great amount of interest was shown and more is expected this year as the prize will be one of the company's latest consoles.

The No. 10 employs three UY-224 screen grid tetrodes in a new design of radio amplifier giving uniformly high selectivity with uniformly good audio quality at all tuning positions of the selector dial. The sensitivity also is uniform for the whole range of the tuning dial and is as high as practicable for a broadcast receiver. The radio amplifier uses five tuned circuits as well as an untuned broad band stage. Four of these tuned circuits are used in two Bi-resonators, while the fifth is used to connect the radio amplifier to the high-level detector. The detector employs a screen grid tetrode which is coupled to the single stage push-pull 245 output tubes by means of a special extra large transformer for insuring correct tone quality.

There is a single selector knob operating an illuminated dial marked with broadcast channel numbers. The volume control and switch, for connecting a phonograph pick-up, operate from one knob which is located at the left of the control panel. The on-off switch and range control (local-distance) are operated by the knob at the right of the panel.

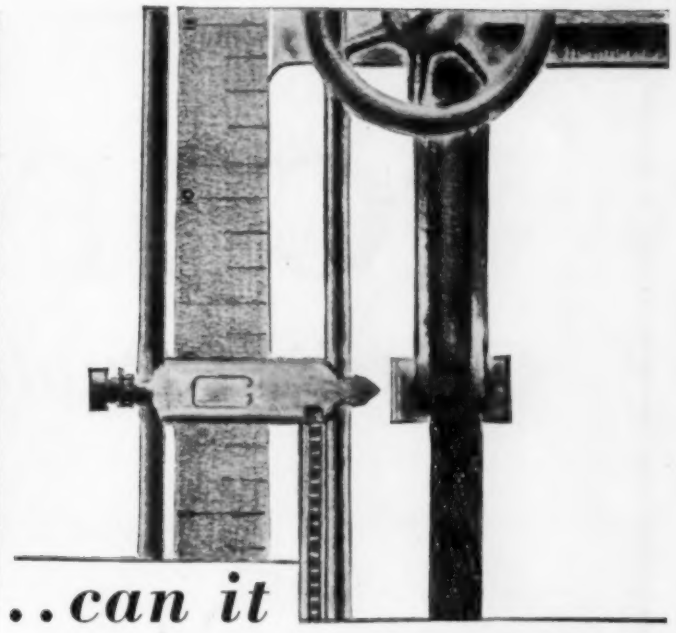
The No. 10 cabinet is an open faced design with a center panel of walnut, decorated with a classical Karvart design and ornamental grille opening at the bottom. The cabinet is 43 inches high by 27 inches wide and 16⅜ inches overall including four short legs.

YOU get genuine value when you buy Ray-O-Vac Telephone Batteries: value in longer life, in quicker comeback after use, in *staying power.* Many companies have standardized on Ray-O-Vacs . . . and it might be a good move for you to follow their example. Ray-O-Vac Telephone Batteries have been proved superior in repeated competitive tests . . . what more can anyone ask?

FRENCH BATTERY COMPANY
MADISON, WISCONSIN
General Sales Office: 20 North Wacker Drive, Chicago, Ill.

RAY-O-VAC

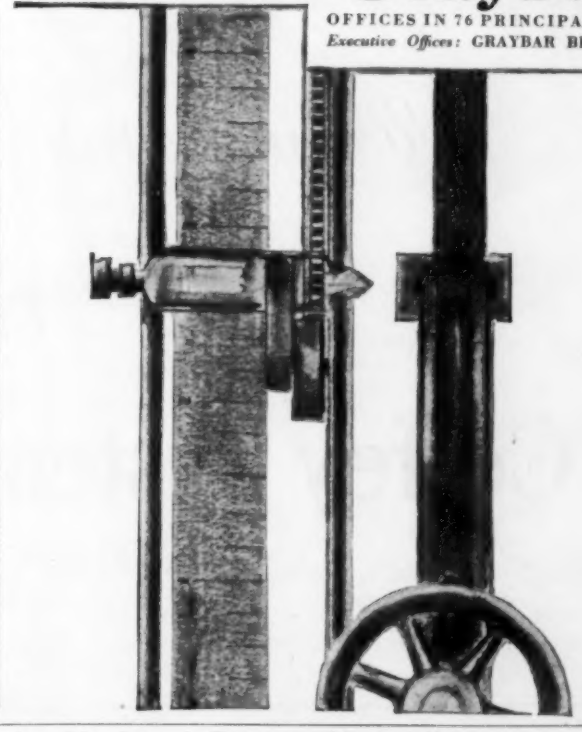
"A", "B", and "C" Radio Batteries; Telephone, Ignition, Flashlight, Aircraft and Autoradio Batteries; Rotomatic and Standard Flashlights; Licensed Radio Tubes.



***..can it meet the* tension test?**

Wise tape users test their tape for strength, adhesion, and quality of materials. Such tests show that all tape is not alike . . . that some tape is more dependable. One sure guide to quality in this and other electrical materials is the name of the supplier. Graybar's reputation, as a quality supplier, goes back over 60 years.

GraybaR
OFFICES IN 76 PRINCIPAL CITIES
Executive Offices: GRAYBAR BLDG., N. Y.



"COFFEY"

Certified Public Accountant

Installations
Rate Cases
Annual Audits
Special Services

See our Exhibit at Convention

Coffey System & Audit Co.

INDIANAPOLIS

TELEPHONE INDUSTRY CARRIES ON

(*Continued from page 32*)

B. L. Fisher, president of the Lee Telephone company, Martinsville, Va., reports that his company will spend $50,000 during the approaching twelve months. Approximately $20,000 will go for land and buildings, $10,000 for underground cable construction, $8,000 for extensions, $5,000 for toll lines, $5,000 for aerial cable construction, and $2,000 for installation.

Another Independent company in the South which will spend close to $50,000 is the North State Telephone company of High Point, N. C. The largest expenditure of this company will be $20,000 for aerial cable construction, according to J. F. Hayden, manager.

The Intra-State Telephone company of Galesburg, Ill., has indicated that its annual budget of $60,000 will not be changed this year, although the 1930-31 expenditures have not been definitely outlined.

The Chenango Valley Telephone company, Chenango Bridge, N. Y., states they will spend $30,000 for improvements in addition to $6,000 already paid on materials for future improvements.

While only a few instances are cited in each section, reports indicate that maintenance schedules are being carried through by companies over the entire United States. Many companies report they are spending nothing for extensions but making necessary repairs to keep their lines in operation and able to afford good service.

The industry as a whole is optimistic and with fair conditions during the coming winter, a revival of business is expected during early spring.

While some of the holding companies made no reports of their activities, it is believed from conservative estimates that total expenditures for the year in the telephone industry from all sources will exceed $1,000,000,000.00 for the year.

MID-WEST MOVES OFFICES TO CHICAGO

Mid-West States Utilities company operating electric power and telephone properties in northern Illinois, Wisconsin, Minnesota, Iowa, Kansas, Oklahoma, Texas and Arkansas, today moved its accounting and general fiscal offices from St. Louis to Chicago. The offices will be in charge of Paul Cowan, secretary-treasurer of Mid-West States.

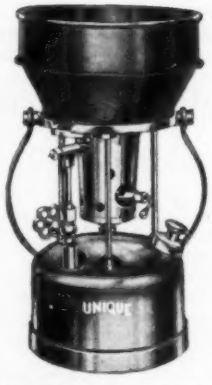
The general administrative offices in charge of Lon J. Jester, vice president and general manager, will remain in St. Louis.

The Chicago offices will be temporarily located at 105 West Adams street.

NEW TELEPHONE SYSTEM

The French telephone administration is experimenting with a system operated by means of wax discs at the sending and receiving ends. You dictate to a disc and attach it to your phone, giving the number of the person you desire called. If he is absent, a recording disc on his telephone will record your conversation. In case you have a dozen calls to make with the same conversation for each one, one disc will serve the purpose.

Furnaces **UNIQUE** Torches



DEPENDABLE

BUILT FOR CABLE SPLICERS

A fine tool for an exacting job, with a reputation for long and trouble-free life!

Sent on Trial

UNIQUE MFG. CO., INC.
221 WHITING ST. CHICAGO, ILL.

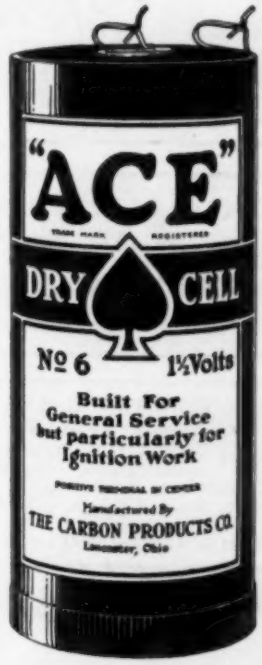
TRAVELERS select the Great Northern for its wonderful location in Chicago's "loop". They return because the large comfortable rooms, homelike environment, attentive service, excellent food and moderate charges make it an ideal hotel.

400 Newly Furnished Rooms
$2.50 a day and up

Sample Rooms
$4.00, $5.00, $6.00
$7.00 and $8.00

Dearborn St. from Jackson to Quincy
New Garage One-Half Block

Outstanding Performance



Precision in their manufacture makes Ace and Victor most uniform.

This uniformity, plus the high standard of their ingredients and laboratory control, assure greater Dry Cell Dependability and longer Dry Cell Life.

Specify Them Always

Bond Electric Corp.
JERSEY CITY

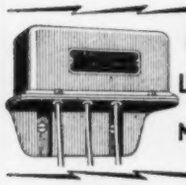
Chicago Lancaster San Francisco

STATISTICS OF A. T. & T. SHOW GROWTH

The magnitude of the telephone business in the United States is shown by some interesting statistics on the man power engaged in that public utility, compiled by the American Telephone and Telegraph Company and recently made public.

There are about 20,000,000 telephones in the Bell System, requiring a force of about 306,000 men and women to maintain and operate it, while about 90,000 others are employed by the Western Electric Company, the manufacturer for the Bell System, and by the Bell Laboratories.

About half the total force of the Bell System is composed of telephone operators. There are 65,000 men and women doing clerical work and 80,000 plant men construct and maintain the telephone lines.



CHAPMAN
LIGHTNING ARRESTERS
MADE BY
MINNESOTA ELECTRIC CO.
MINNEAPOLIS, MINN.

ACCOUNTING
Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
Certified Public Accountants
901-7 Continental Bank Bldg., Indianapolis, Ind.

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys Financial Investigations, Organization and Operation of Telephone Companies
J. G. Wray, Fellow A. I. E. E.
Cyrus G. Hill
Rm. 2130 Bankers Bldg., Chicago

RECONSTRUCTED EQUIPMENT

Kellogg No. 2696 type 4-bar 1600 ohm Bdg. compacts @ $8.50—5-bar @	$10.00
Western Elec. No. 317 inside connection 3-bar 1000 or 1600 ohm Bdg. compacts @ $8.75—5-bar @	10.00
Stromberg-Carlson No. 896 5-bar 1600 ohm Bdg. compacts @	10.50
Dean Elec. No. 240 4-bar 1000 or 1600 ohm Compacts with Kellogg Trans. @	7.00
Am. Elec. No. 36 4-bar 1000 or 1600 ohm Bdg. compacts @ $6.50—5-bar @	8.25
Western Elec. No. 240 external post connection 3-bar 1000-1600 or 2500 ohm Bdg. hotel sets @	5.00
Leich desk set complete with Stromberg 4-bar 1000 or 1600 ohm signal sets @	8.75
Leich Elec. 30-42-54 and 66 cycle Harmonic ringers less gongs @	1.25
Western Elec. No. 293 C. B. Straight line black finish wood hotel sets @	6.50
Kellogg Grounded type transmitters, complete with back @	.90
Kellogg insulated type transmitters with back @	1.10
Western Elec. No. 323-329 or No. 350 insulated type Transmitters @	1.25
Western Elec. No. 143 Receivers complete with New Cords @	1.25
Automatic Elec. or Dean Slip type Receivers with new cord @	1.10

Write for Bulletins
REBUILT ELECTRIC EQUIPMENT CO.
1940 West 21st Str., Pilsen Station
Chicago, Ill.

ILLINOIS BELL VOTES $1,332,011 FOR PLANTS

Illinois Bell Telephone Company's executive committee authorized the expenditures of $1,051,241 on new plant in Chicago and $280,770 in Illinois outside of Chicago, making the total expenditures authorized at this meeting $1,332,011. Expenditures authorized so far this year aggregate $16,892,176.

Dividend action was not taken at this time because of the lack of a quorum. Next dividend payment will be due September 30.

A. T. & T. SEEKS C. & P. STOCK

The American Telephone and Telegraph Company has asked the Maryland Public Service Company for permission to purchase the capital stock of Chesapeake and Potomac Telephone Company of Baltimore for $3,175,700, according to dispatches from Baltimore yesterday. The Chesapeake and Potomac at the same time asked for permission to issue additional common stock to the amount mentioned.

ASSOCIATED TELEPHONE REGROUPS UNITS

Plans for further consolidations of operating companies of the Associated Telephone Utilities system will be carried to completion during the remainder of 1930, according to an announcement.

The consolidation plan will result in grouping the operating companies so that there will be one large operating unit in each of the twenty states in which the system serves. Increased efficiency of management and additional economies in operation are expected to result from the plan.

Consolidations have already been practically completed in Illinois, served by Illinois Commercial Telephone company; in Wisconsin, served by Commonwealth Telephone company; in Iowa, served by Iowa State Telephone company; in Missouri, served by Central Missouri Telephone company; in Idaho and Washington, served by Interstate Utilities company, and in California, served by Associated Telephone Company, Ltd. Regrouping is being effected in New York, Pennsylvania, Ohio, Indiana, Michigan, Oklahoma and Texas.

Wants

FOR SALE—Used equipment just removed from service because of cutover to automatic. No. 1317-R. W. E. 5-bar 1600-ohm Wall Telephones, $7.00 each; No. 300-M W. E. 5-bar 1600-ohm Bell Boxes, $7.00 each; No. 300-K W. E. 5-bar 2500-ohm Bell Boxes, $7.00 each; 2 No. 1320-A W. E. Common Battery Street or Mine Telephones, $20.00 each; No. 1040-AL W. E. Desk Stands, $5.00 each; No. 1533-A W. E. Common Battery Wall Sets, $5.00 each; No. 7 and No. 20 3-slot Gray Pay Stations, $3.00 each; No. 1001-A. W. E. Hand Test Sets, $3.00 each. All in good working order. Also 1 No. 550-B W. E. 80-line PBX Switchboard, $200.00. 1000 lbs. switchboard cable at junk prices. Over $2000.00 worth of equipment already disposed of without a single complaint. Numerous other items at equally attractive prices. The Orange County Telephone Co., Middletown, N. Y.

FOR SALE—No. 17 gauge, new style double conductor, black parallel weatherproof drop wire. This wire is brand new, fresh stock in 1,000-foot coils. While it lasts, $7.00 per 1,000 feet. Wm. M. Miller & Sons, 2553 W. Madison St., Chicago, Ill.

Send for free sample and prices on
UNIVERSAL DROP WIRE INSULATORS
Universal Specialty Company
711 Poplar St., Terre Haute, Ind.

FOR SALE
200 Slightly Used Operators Chairs, $2.50 to $3.50 each.
Porcelain Knobs, 2 groove, $1.00 per 100, 4 groove, $2.00 per 100.
Bakelite Mouth-pieces for W. E. Transmitters, $6.00 per 100.
Gray No. 7 and No. 11, Pay-Stations 3 slot.
The Telephone Repair Shop
1760 Lunt Ave., Chicago, Ill.
Telephones bought, sold and repaired. We list telephone plants for sale or exchange.

Western Electric Co. Apparatus

No. 323 Insulated Transmitters (with back and bolt)	$1.00
No. 329 Insulated Transmitters (with back and bolt)	$1.00
No. 21 2-MF Condensers	.50
No. 20 Induction Coils	.35
No. 1020-AL Desk Stands (complete)	4.50
No. 6 and No. 8 2500 ohm Biased Ringers	1.00

Buckeye Telephone & Supply Company
COLUMBUS, OHIO